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BOMBAY BRANCH
OF THE
Royal Asiatic Society.

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REPORT

ON

SANITARY MEASURES IN INDIA IN 1885-6;

TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1887.

VOL. XIX.

Presented to both Houses of Parliament by Command of Her Majesty.

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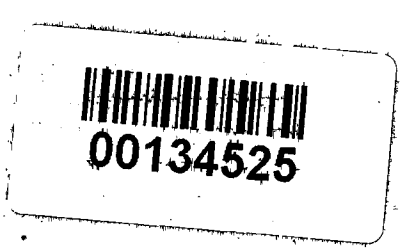

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CONTENTS.

REPORT.

	Page
I. European Army:	
Sickness and mortality in 1885	1
Cholera	2
Small-pox	3
Fevers	3
Bowel complaints	3
Venereal diseases	3
Invaliding	4
II. Native Army:	
Sickness and mortality in 1885	5
Bengal	5
Madras	7
Bombay	7
III. General Population:	
Mortality from chief diseases	8
Bengal	8
Madras	9
Bombay	10
Punjab	11
North-Western Provinces and Oudh	12
Central Provinces	13
Berar	14
Assam	15
Lower Burma	15
IV. Jails:	
Sickness and mortality in 1885	17
Bengal	17
Madras	18
Bombay	18
Punjab	19
North-Western Provinces and Oudh	19
Central Provinces	20
Berar	20
Assam	21
Lower Burma	21
V. Vaccination:	
General results	22
Bengal	22
Madras	22
Bombay	22
Punjab	23
North-Western Provinces and Oudh	23
Central Provinces	23
Berar	23
Assam	24
Lower Burma	24
VI. Medical Institutions:	
Civil Hospitals and Dispensaries:	
Bengal	25
Madras	25
Bombay	26
Punjab	26
North-Western Provinces and Oudh	27
Central Provinces	27
Berar	27
Assam	28
Lower Burma	28
Lock Hospitals:	
Working of the Contagious Diseases Act	28
Bengal	29
Madras	29
Bombay	30
Punjab	30
North-Western Provinces and Oudh	30
Central Provinces	30
Lower Burma	31
Lunatic Asylums:	
Bengal	31
Madras	32
Bombay	32
Punjab	32
North-Western Provinces	32
Central Provinces	33
Assam	33
Lower Burma	33
Medical Schools:	
Bengal	33
Madras	34
Bombay	34
North-Western Provinces and Oudh	35
Punjab	35
VII. Sanitation:	
Civil:	
Bengal	36
Madras	36
Bombay	37
Punjab	38
North-Western Provinces and Oudh	38
Central Provinces	38
Berar	38
Assam	39
Lower Burma	39
Military:	
Bengal	39
Madras	39
Bombay	40

ABSTRACTS.

	Page
India Sanitary Report for 1885:	
European troops	43
Native troops	58
Jails	64
General population	74
History of chief diseases	77
Vaccination	86
Sanitary works	90
General remarks	95
Note on the Experimental closure of several lock hospitals during 1885	97
Madras Sanitary Report for 1885:	
European troops	107
Native troops	108
Jails	108
General population	110
Vaccination	115
Sanitary works	115
General remarks	117
Bombay Sanitary Report for 1885:	
General population	120
Vaccination	123
Sanitary works	124
Personal Proceedings and General Remarks	126
Calcutta Municipal Report for 1885-86	130
Calcutta Health Ditto	137
Madras Municipal Ditto	143
Bombay Municipal Ditto	146
Bombay Health Ditto	150

APPENDIX.

	Page
Memoranda by Army Sanitary Commission on	
India Sanitary Report for 1885	156
Madras Ditto Ditto	171
Bombay Ditto Ditto	182
Bengal Ditto Ditto	189
Punjab Ditto Ditto	202
North-Western Provinces and Oudh Ditto	211
Central Provinces Ditto Ditto	220
Berar Ditto Ditto	227
Assam Ditto Ditto	236
Lower Burma Ditto Ditto	2
Rajputana Dispensary, Vaccination, Jail, and Sanitary Report for 1885	2
Calcutta Municipal Report for 1884–85	2
Ditto Ditto 1885–86	2
Bombay Ditto 1885	
Health Returns of Madras Troops for 1885	
Health Returns of Bombay Troops for 1885	
Reports of Fairs and Festivals held within the Presidency of Madras during 1885	
Ditto Ditto Ditto 1886	

HORACE WALPOLE,
Assistant Under Secretary

India Office,
23rd September, 1887.

REPORT.

I.—EUROPEAN ARMY.

Sickness and mortality in 1885.

THE health of the European Army of India during 1885 was less favourable than in either of the three preceding years. Of an average strength of 56,967 (according to the report of the Sanitary Commissioner with the Government of India, Dr. B. Simpson), excluding troops on active service in Burma, the admissions into hospitals were in the ratio of 1,533 per 1,000, the daily sick 71 per 1,000, and the mortality 14·55 per 1,000. The loss by invaliding was 23 per 1,000, a much lower ratio than usual, bringing the total loss to the army from death and invaliding to 37 per 1,000.

The proportions in which the armies of the three Presidencies contributed to these results as compared with 1884, were as follows:—

Presidency.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total loss.
Bengal	1884	33,486	1,662	70	11·68	32	44
	1885	35,031	1,661	73	13·16	20	33
Madras	1884	10,785	1,109	57	8·53	32	40
	1885	10,519	1,154	66	9·13	24	33
Bombay	1884	10,725	1,455	65	19·39	31	51
	1885	11,417	1,489	68	23·82	29	53
INDIA	1884	54,996	1,513	67	12·56	32	44
	1885	56,967	1,533	71	14·55	23	37

From the above statement it will be seen that the Madras Army was as usual the healthiest branch of the Indian European service, and that the Bombay Army showed the worst results, which was again due chiefly to the heavy mortality from cholera among the troops in Southern Afghanistan.

In all three Presidencies malarial fevers and venereal diseases caused the largest proportion of sickness, and enteric fever, cholera, dysentery, and hepatitis were the principal death causes. As regards cholera, the mortality was less among the Bengal and Madras troops than in 1884, while in the Bombay Army the death-rate under this head rose from 4·85 per 1,000 to 6·92; but, as already stated, the disease was chiefly confined to the troops serving in Southern Afghanistan, among whom there were 71 fatal cases out of a total of 79 for the whole Bombay Army.

Concerning the troops stationed in Bengal, which comprised nearly two-thirds of the entire army of India, the admission and daily sick-rates were but very little in excess of those of 1884, especially the former, which was practically the same, while the mortality was substantially higher. On the other hand, the loss by invaliding was 12 per 1,000 below 1884, and the total loss from death and invaliding 11 per 1,000 less. Of the six groups of stations into which the Bengal Presidency is divided, the Meerut and Rohilkund group returned the highest admission and death-rates, viz., 2,463 and 18·00 per 1,000 respectively, against 2,028 and 17·01 in 1884, and it was the only one which exceeded the Presidency ratios. In all the other groups, except that of Agra and Central India, the mortality was greater than in the previous year, and here the death-rate declined from 15·53 to 10·93 per 1,000. Malarial fevers and venereal diseases contributed most largely to the admissions in all groups, the former varying from 1,322·5 per 1,000 to 361·8, and the latter from 422·9 to 322·2. Enteric fever was the chief cause of mortality in all the groups excepting Bengal Proper, where cholera and fevers other than enteric gave rise to the highest proportion of deaths.

Among individual stations whose average strength exceeded 200, and which were occupied the whole year, the highest admission-rates were recorded at Delhi (4,185)

and Muttra (3,024) ; ten other stations had ratios over 2,000 ; while in no station was the admission-rate under 1,000. The highest death-rate in any single station again occurred in Quetta, viz., 83·86 ; Muttra followed with 41·78, and in seven other stations the mortality ranged between 20 and 30 per 1,000. Cholera, dysentery, and respiratory diseases were the chief death causes at Quetta. Of the total 71 cholera deaths which occurred among the troops in Southern Afghanistan all but two took place at Quetta. The chief causes of death at Muttra were enteric fever and cholera.

The health statistics of the troops in the Hill stations of Bengal with an average strength of 4,000, were not so favourable as in the previous year, the admission-rate having risen from 1,201 per 1,000 to 1,395, and the death-rate from 5·91 to 9·50.

In the Rajputana, Malwa, Sind, and Aden group, with an average strength of 5,011, the health of the troops was also unfavourable, though there was slightly less sickness. The admission-rate declined from 1,548 in 1884 to 1,503, and the death-rate rose from 12·77 to 14·97. The diseases giving rise to this increased mortality were enteric fever, the death-rate from which rose from 2·02 to 3·19, apoplexy and sunstroke, and cholera. At Mhow and Aden, the two largest stations in this group, the admission-rates were 1,261 and 1,178 against 1,799 and 1,167 in 1884, and the death-rates 10·26 and 15·67 against 6·69 and 8·51 respectively.

Among the troops located in the Deccan and Nagpur (average strength 7,647) the admission-rate was nearly the same as in 1884, viz., 1,169 against 1,171, and the death-rate was 9·67 against 8·83. The most fatal disease was enteric fever, which contributed 2·75 to the death-rate, other fevers following with a mortality of 0·66, and respiratory diseases with 0·52 ; from cholera there were two deaths, or 0·26 per 1,000. The largest stations in this group are Secunderabad and Poona. At the former, with an average strength of 2,489, the admissions were in the ratio of 1,133 per 1,000, and the death-rate 10·45 ; and at Poona the admission-rate was 1,366 per 1,000 of an average strength of 1,145, and the death-rate 12·23.

In the Southern India group the health statistics of the troops were again very favourable. Of an average strength of 4,069 the admissions to hospital equalled 1,157 per 1,000, against 1,059 in 1884, and the mortality 6·88 against 7·73. Enteric fever (1·72) and hepatitis (1·23) were the chief death causes. There are seven stations in this group, and at the two largest, Bangalore and Bellary, the admission-rates were 1,048 and 1,460 per 1,000, and the death-rates 3·45 and 5·24 respectively. In both the admission-rates were higher than in 1884 and the mortality lower.

The average strength of the troops stationed in Burma and Pegu during 1885 was 2,077, excluding troops on active service. Among them the admissions were in the proportion of 1,215 per 1,000 against 1,190 in 1884, and the death-rate 12·52, against 7·28. Deaths from violence comprised nearly a third of the total mortality. There were two deaths from enteric fever, against none in the previous year, and other diseases giving rise to increased mortality were cholera, other fevers, apoplexy and sunstroke, heart disease, and phthisis. Of the four stations in this group Thayetmyo returned the highest death-rate, viz., 14·84.

Judged by the mortuary statistics, the health of the men located in the Hill stations of Madras and Bombay during 1885 was extremely unfavourable. The average strength was 584, and the admission-rate was 1,447 per 1,000 against 1,531 in 1884, and the death-rate 18·84, against 5·28, and a decennial average of 15·16 per 1,000. Enteric fever and hepatitis each contributed 3·43 to the mortality, and other fevers and respiratory diseases each 1·71.

The health of the Bombay troops (1,672) serving in Southern Afghanistan was again most unfavourable. The admission-rate rose from 2,056 in 1884 to 2,187, and the death-rate from 68·70 to 83·13. Cholera was the most prominent death cause, contributing just over a half (42·46) of the total mortality, dysentery and respiratory diseases following. Enteric fever was much less prevalent and fatal than in 1884.

Of the chief diseases from which the European troops suffered, cholera was much more prevalent during 1885 than in either of the three preceding years, though the type of the disease was less virulent. Altogether there were 199 cases or 49 more than in 1884, and of these 122, or 61·31 per cent., were fatal, against 107, or 71·33 per cent. in 1884. The great majority of the cases (129) occurred in the Bombay Army, which also contributed 79 deaths out of a total for the whole European Army of 122. The disease was less prevalent among the Bengal troops than in the previous year, the number of cases having declined from 71 to 64, and the deaths from 45 or 1·34 per 1,000 of average strength to 41 or 1·17. In the Madras Army there were only 6 cases

and 2 deaths against 12 cases and 10 deaths in 1884, the death-rates being 0·19 and 0·93 respectively.

Small-pox.

Small-pox was much less prevalent than usual; there were only 12 cases, and none of these proved fatal; whereas in 1884 there were 78 cases and 8 deaths, 6 of which occurred in the Bengal Presidency.

Fevers.

Intermittent fever was somewhat less prevalent than in 1884, and yielded an admission-rate of 471 against 487. The decrease was confined to the Bengal and Madras armies, for among the Bombay troops the admission-rate rose from 420 in 1884 to 509. But one third of this high rate was contributed by Southern Afghanistan. There were only two deaths under this head, both of which occurred in the Bengal Presidency. From remittent and continued fevers the admission-rate declined from 60 per 1,000 in 1884 to 48, all three Presidencies sharing in the diminution; but there was a small increase in the mortality from 0·62 to 0·68, which was confined to Bengal and Madras, as in Bombay the death-rate showed a reduction.

Enteric fever continues to head the death list in the army as a whole. There was a slight decrease in the admissions as compared with the previous year, but a considerable rise in the mortality. There were 640 cases, or four less than in 1884, the ratio per 1,000 of strength being 11·2 against 11·7. The fatal cases numbered 194, or 3·41 per 1,000 of average strength, against 151 or 2·74 in 1884. As regards the individual armies, enteric fever was far more prevalent in the Bengal Army than in those of Madras and Bombay, while in all three the mortality was greater than in 1884. In the Bengal Army the death-rate was 4·05 per 1,000, against 3·31 in 1884; in Madras 2·19 against 1·67; and in Bombay 2·54, against 2·05. At several groups of stations enteric fever was very prevalent, especially in the Gangetic Provinces, which returned a mortality of 6·24 per 1,000. The year's statistics again point to the conclusion that young and unacclimatised soldiers are particularly subject to this disease, and that liability to its attacks diminishes with length of service, for amongst troops under 25 years of age the death-rate equalled 5·16 per 1,000, against 4·61 in 1884, while amongst men from 25 to 29 years of age the ratio was 2·30, against 1·83; amongst troops in their first and second year's service the mortality was 6·55 per 1,000, against 5·47 in 1884, and of troops from three to six years' residence the ratio was 1·93 against 1·55. The year's experience of newly-arrived regiments also testifies to the liability of unacclimatised soldiers to enteric fever, the death-rate (7·72) being more than double that of the army generally. The Sanitary Commissioner reports that as a rule medical officers were unable to attribute this fever to any definite cause. "Considering "the facts regarding enteric fever as a whole," the Army Sanitary Commission state, "and apart from strictly professional questions as to its diagnosis and etiology, the "evidence in the present and preceding reports appears to connect the disease with "those prevailing malarial conditions which influence the nature and amount of fever "at intertropical stations generally, and we know from the statistics that wherever "enteric fever shows itself at the stations, the whole surrounding population suffers "year after year from miasmatic fevers."

Bowel complaints.

Dysentery and diarrhœa were both more general than in the previous year, and the former was more fatal, the mortality having risen from 0·38 per 1,000 to 0·86; from diarrhœa the death-rate was 0·05 per 1,000, against 0·09 in 1884. Taking the armies separately, dysentery was again most prevalent in Madras, but the largest proportion of deaths to strength (2·89) occurred in Bombay, which was due to the inclusion of the statistics of Southern Afghanistan. Diarrhœa was most prevalent in the Bengal Army, but most fatal in the Bombay Army.

Venereal diseases.

Each year witnesses to an increase in admissions from venereal diseases. From all forms of the disease the admissions per 1,000 of strength in 1885 was 343, against 294 in 1884. The increase was, however, confined to the Bengal and Madras armies, which returned ratios of 363 and 350 per 1,000 respectively, against 291 and 307 in 1884, for in Bombay the ratio declined from 292 to 272 per 1,000. During the year the question of the utility of preventive measures in checking the prevalence of venereal disease among European troops was carefully considered by the Indian Government, and an interesting note on the subject by Surgeon-Major A. Barclay, forming an appendix to the Sanitary Commissioner's Report, will be found at page 97.

Invaliding.

The statistics of invaliding show that throughout the whole European Army 1,303 men, or 22·87 per 1,000, of strength were invalided during 1885, against 1,757 or 31·74 in 1884. Of these, 40 per cent. were discharged as unfit for further service. The lowest rate of invaliding was yielded by the Bengal Army, viz., 20·34 per 1,000, Madras coming next with 24·21, and Bombay with 29·02. In all three armies anæmia and debility were as usual the chief causes of invaliding; from mental diseases the total cases declined from 88 in 1884 to 75, but the reduction took place only in Bengal, as the other two Presidencies showed an increase, especially Bombay. In regard to age, the percentage of those invalided under 25 years of age was 42·13 for the entire army, a higher percentage than in the two preceding years (38·70 and 36·55); and with reference to residence, men between two and five years' service showed the largest proportion of invalids, viz., 54·64 per cent., against 49·97 in 1884 and 49·97 in 1883. The percentage of men invalided under two years' residence was 22·56, against 24·19 in 1884.

II.—NATIVE ARMY.

Sickness and mortality in 1885.

The health of the Native troops of India during 1885 was on the whole favourable. There was less sickness than in the previous year, the admission and daily sick-rates, excluding men on active service in Burma, having declined from 1,042 and 33 per 1,000 of strength respectively, to 978 and 32 per 1,000; but the mortality was greater, 13·67, against 10·50 per 1,000 in 1884, or including absent deaths 16·09, against 12·22. In a great measure this increased mortality was due to cholera, especially among the Bombay troops in Southern Afghanistan.

The sickness and mortality in the several branches of the Native Army are given in the following statement:—

		Average Strength.	Ratio per 1,000.			
			Admissions.	Daily Sick.	Deaths.	Total Deaths, including Absentees.
Bengal Native Army	1884	40,850	1,193	35	10·97	12·56
	1885	40,753	1,076	34	10·11	14·18
Madras ditto	1884	28,050	836	31	10·02	11·82
	1885	27,043	675	25	9·69	13·96
Bombay ditto	1884	23,373	1,153	38	12·96	14·35
	1885	22,701	1,243	43	24·84	26·01
Central India Regiments	1884	5,082	644	29	5·90	7·23
	1885	5,112	700	19	10·17	11·54
Punjab Frontier Field Force	1884	10,458	1,262	36	10·71	14·00
	1885	10,576	1,152	35	12·67	14·50
Hyderabad Contingent	1884	7,014	574	19	4·56	5·30
	1885	6,969	522	17	5·88	7·57
INDIA	1884	114,827	1,042	33	10·50	12·22
	1885	115,486*	978	32	13·67	16·09

* Including troops on service in Egypt, but excluding those on active service in Burma.

It will be seen from the above that the Hyderabad Contingent and the Madras Army enjoyed the best health, followed closely by the Central India Regiments; while the worst results were recorded in the Bombay Army and the Punjab Frontier Force. As regards the Bombay Army the returns were again vitiated by the extreme unhealthiness of the troops in Southern Afghanistan.

Malarial fevers again gave rise to the largest number of admissions into hospital in the Native Army as a whole, and next came respiratory diseases, rheumatism, abscess, and ulcer, "marking" the Army Sanitary Commission observe, "a general prevalence of "defective constitutional habit." Respiratory diseases, as usual, contributed the highest death-rate, viz., 3·74 per 1,000, against 2·97 in 1884; fevers followed with a mortality of 2·20, and next in order came cholera with 1·61, a higher death-rate than in either of the preceding five years, dysentery and diarrhœa with 1·29, and phthisis with 0·69.

Bengal Native Army.

Among the Bengal troops, comprising nearly a third of the Native Army of India, sickness and mortality were less than usual, the admission-rate of 1885 (1,076 per 1,000) being lower than in any year except 1883, and the death-rate was the lowest on record, though including deaths out of hospital the mortality rose from 12·56 per 1,000 in 1884 to 14·18. From the majority of the chief diseases there were fewer admissions than in 1884, while the highest death-rates were contributed by respiratory diseases (2·77, the same rate as in 1884), phthisis (1·13 against 0·98), and anæmia and debility (0·37 against 0·34). In the whole Bengal Native Army there were only 17 cases of cholera, of which 12 terminated fatally, against 41 cases and 29 deaths in 1884.

As regards the geographical distribution of the Bengal Native Army, the following table gives the principal statistics of the several groups:—

		Average Strength.	Ratio per 1,000.		
			Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1884	5,682	1,367	42	14·61
	1885	5,722	1,278	39	9·96
Gangetic Provinces	1884	7,500	929	32	6·00
	1885	6,390	990	32	6·42
Rohilkund and Meerut	1884	5,180	1,188	43	10·62
	1885	5,476	1,179	45	10·04
Agra and Central India	1884	4,722	1,312	37	7·84
	1885	4,467	1,333	39	8·28
Punjab	1884	14,928	1,083	29	8·49
	1885	15,631	902	28	9·92

It will be seen from the above statement that only in the Gangetic Provinces and Agra and Central India groups were the admission-rates in 1885 in excess of the previous year, and that the mortality was greater in the three groups of the Gangetic Provinces, Agra and Central India, and the Punjab. The greatest increase in mortality occurred in the Punjab group, and this was due mainly to cholera, dysentery, respiratory diseases, and hepatitis. Cholera was present in all the groups, though to no very great extent; fevers gave rise to the highest mortality in the Punjab, Meerut and Rohilkund, and Lower Bengal and Assam groups; bowel complaints were most fatal in Agra and Central India, and Lower Bengal and Assam groups; and respiratory diseases were mostly felt in the Punjab, where more than a third of the total mortality occurred under this head, in Agra and Central India, where they occasioned 3·14 of the total death-rate of 8·28, and in Meerut and Rohilkund.

Of individual stations in the Bengal Presidency occupied throughout the year, nine returned admission-rates averaging from 1,500 to 2,000 per 1,000, Baxa, Gumbaz, Doranda, Delhi, Naga Hills, and Morar having recorded the highest ratios. The highest mortality was returned by Gumbaz, viz., 50·31 per 1,000 of an average strength of 318, Khelat-i-Killa following with 45·77 of an average strength of 568, and Sipri and Umballa coming next with 23·26 and 21·11 respectively.

In the Punjab Frontier Force the admission and daily sick-rates were the lowest on record, being 1,152 and 35 per 1,000 respectively of an average strength of 10,576, against 1,262 and 36 in 1884; the death-rate, however, rose from 10·71 to 12·67, or, including absent deaths, from 14·00 to 14·50 per 1,000. Of the total 134 deaths in this force exactly a half (67 or 6·34 per 1,000 of strength) were from respiratory diseases; fevers gave rise to 33 deaths, or 3·12 per 1,000. There was no cholera in the force during the year.

Among the troops in the Central India Regiments the results were unfavourable as compared with the previous year, especially in regard to mortality. Of an average strength of 5,112, the admissions to hospital were in the ratio of 700 per 1,000, against 644 in 1884, and the deaths rose from 30 or 7·23 to 52 or 10·17, or, including absent deaths, from 7·23 to 11·54. This increase of mortality was due chiefly to the greater prevalence of cholera, respiratory diseases, and fevers. From cholera there were 9 deaths, or 1·76 per 1,000, against one fatal case in 1884, and from respiratory diseases there were 22 deaths, or 4·30 per 1,000, against 12 or 2·36.

The Hyderabad Contingent continued to hold its place as being the most healthy of all the Native corps, though the mortality was slightly greater than in 1884. The admission-rate declined from 574 per 1,000 to 522, and the daily sick from 19 to 17 per 1,000, while the death-rate was 5·88 per 1,000 of an average strength of 6,969, or 1·32 per 1,000 in excess of 1884; including absent deaths the death-rate was 7·57 per 1,000, against 5·30 in 1884. Cholera and respiratory diseases accounted for nearly the whole of the increase, the number of deaths from the former having risen from 2 to 7, and the latter from 9 to 13.

Madras Native Army.

The statistics of the Madras Native Army for 1885, excluding the portion on active service in Burma, were again very favourable, the respective ratios being the lowest since 1877. The admission-rate per 1,000 of an average strength of 27,043 was 675, against 836 in 1884, the daily sick 25 per 1,000, against 31, and the death-rate 9·69, against 10·02; including absent deaths the mortality was higher than in the previous year, 13·96 against 11·82. There were 262 deaths in hospital, and of these 41, or 1·52 per 1,000 of strength, were from respiratory diseases, against 48, or 1·71 in 1884; from cholera there were 35 fatal cases, or 1·29 per 1,000, against 41, or 1·46; and from fevers 38 deaths, or 1·41, against 44, or 1·57. Small-pox accounted for 22 admissions, but none were fatal, whereas in 1884 there were 100 cases with 6 deaths.

Of the larger stations in the Madras Command with an average strength exceeding 1,000 men, sickness was again most prevalent at Secunderabad, the admission-rate being 1,096 per 1,000, Kamptee following with 608, Bangalore with 571, and Bellary with 497. In regard to mortality the highest rate (41·34) was returned by the troops in Southern Afghanistan. The actual number of deaths was 32, of which 16 were from bowel complaints and 11 from respiratory diseases. The four next highest ratios were 17·49 at Toungoo, 14·39 at Vellore, 11·83 at Jubbulpore, and 11·03 at Secunderabad. At the latter station, where the largest Native force was quartered, there were 38 deaths, and 11 of these resulted from fevers, 7 from respiratory diseases, and 5 from cholera.

Bombay Native Army.

In the Bombay Native Army both the admissions to hospital and deaths in 1885 were more numerous compared with recent years. The admission-rate rose from 994 in 1883 and 1,153 in 1884 to 1,243 per 1,000, the daily sick-rate from 38 in 1884 to 43, and the death-rate from 12·96 to 24·84, or, including absent deaths, from 14·35 to 26·01. The increase in mortality was spread over the majority of the causes, particularly cholera, fevers, dysentery and diarrhœa, and respiratory diseases, which yielded 431 of the total 564 deaths. Cholera alone contributed 123 deaths, or 5·42 per 1,000, against 9 deaths in 1884; fevers 83, or 3·66, against 42, or 1·80; dysentery and diarrhœa 56, or 2·47, against 40, or 1·71; and respiratory diseases 169, or 7·44, against 105, or 4·49. But these unfavourable results were chiefly due to the excessive admission-rate and mortality (2,832 and 100·81 per 1,000 respectively) among the Bombay troops in Southern Afghanistan. Of an average strength of 3,700 these troops contributed over 57 per cent. of the total mortality of the Bombay Army.

Of the other divisions of the Bombay Command, that of Konkan came next to Southern Afghanistan in order of mortality (16·32), while the Northern Division was the most healthy part of the Presidency, where the death-rate was only 5·57 per 1,000. In the Bolan Pass and in the Pishin Valley the admission-rates were 3,762 and 3,418 per 1,000 respectively; fevers, bowel complaints, respiratory diseases, cholera, and rheumatism were the chief contributors. Of individual stations with over 1,000 men, Quetta returned the highest admission-rate (2,734 per 1,000) and Bombay the lowest (528). Nine stations recorded a mortality of over 20 per 1,000; of these, five are in Southern Afghanistan, with death-rates averaging from 191·14 in the Bolan to 63·06 in Sibi. The Persian Gulf stations followed with 35·09, Malegaon coming next with 31·82, Surat with 24·88, and Kurrachee with 24·32.

III.—GENERAL POPULATION.

THE population under registration in the several provinces of India in 1885, including Calcutta, numbered 198,018,569. Births were registered throughout all the provinces excepting Lower Bengal, where the system of limited registration has been in force for some years, and during the year under notice was confined to 46 towns. The registered provincial birth-rates varied between 17·48 and 45·36 per 1,000. In all cases the births recorded were in excess of the deaths. The registered deaths numbered 5,182,597, or 26·12 per 1,000 against 5,239,218 or 26·44 in 1884. Of this mortality the Army Sanitary Commission notice that 78 per cent. was due to mitigable or preventable diseases, stating "that the sanitary problem in India is precisely what it has always been, "namely, the executive removal of epidemic and endemic local disease causes."

The following table gives the registered mortality in the different provinces of India from the chief diseases in 1885, and also that from all causes as compared with 1884:—

	Cholera.		Small-pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1885.	1884.
Bengal, excluding Calcutta	173,767	2·62	9,863	0·14	1,042,142	15·75	63,808	0·96	1,504,745	22·74	20·83
Calcutta	1,003	3·69	155	0·36	3,831	8·84	1,655	3·82	12,707	29·30	30·59
Madras	58,109	2·06	34,726	1·23	218,786	7·77	31,209	1·10	615,449	21·86	23·07
Bombay	37,287	2·27	2,646	0·16	314,237	19·10	45,056	2·73	473,591	28·78	24·82
Punjab	1,936	0·10	7,575	0·40	346,763	18·40	17,711	0·94	507,140	26·91	35·04
North-Western Provinces and Oudh	63,457	1·44	14,593	0·33	1,124,150	25·48	64,409	1·46	1,410,639	31·98	35·26
Central Provinces	21,868	2·48	3,364	0·38	170,634	19·35	27,455	3·11	301,684	34·21	27·30
Berar	3,683	1·40	259	0·09	37,359	14·19	15,785	6·00	89,558	34·05	24·63
Assam	7,753	1·71	1,980	0·44	72,482	16·01	19,396	4·29	126,344	27·91	29·37
Lower Burma	7,685	2·10	2,120	0·58	34,070	9·32	3,254	0·89	72,672	19·89	18·95
Mysore	2,677	0·65	3,264	0·80	33,280	8·13	5,429	1·32	65,119	15·91	14·93
Coorg	—	—	240	1·34	2,356	13·21	126	0·70	2,956	16·57	15·08
Total	379,325	1·90	80,785	0·40	3,400,070	17·17	295,293	1·44	5,182,597	26·12	26·44

During 1885, registration of births in Bengal Proper was carried out in 46 towns, or one less than in the previous year. The results show some slight signs of improvement, the number of births recorded having risen from 39,640, or 23·51 per 1,000 of population in 1884, to 41,133, or 24·71; but the ratios of individual towns, varying from 53·23 to 7·94 per 1,000, point to the unsatisfactory manner in which registration is still performed.

More interest appears to have been manifested in the registration of deaths, though the results are still far from satisfactory. Within the area in which registration of deaths was carried on, 1,504,745 persons were reported to have died, being in the ratio of 22·74 per 1,000 of population against 1,378,610, or 20·83, in 1884, showing an increase in 1885 of 126,135 deaths. But besides these a great number of deaths was caused by the cyclonic storm which occurred in Orissa on the 22nd of September. These were not recorded in the year's statistics, owing to the persons whose duty it was to record them having perished with the inhabitants. It is estimated that in Orissa alone about 15,000 lives were lost in this way. The Sanitary Commissioner, Dr. Lidderdale, reports that "the sea shore was lined with bodies whitened on the sand, "and many corpses and carcases of animals were left in the creeks, rivers, tanks, fields, "ditches, &c." The Compulsory Registration Act was in force in 117 towns and one rural area in Darjiling, and as in these the work of registration is, in future, to be performed by municipal agency, better results are expected. "The data, as a whole," the Army Sanitary Commission observe, "can only be accepted as showing the present "state of the registration, and, roughly, the year's losses by death . . . Accepting "the data as they stand, it happens, unfortunately, that, when compared with the data "of former years, these hold out no proof or promise that the public health of Bengal "is undergoing any material change for the better, if, indeed, they do not point in an "opposite direction."

The year's returns show an increased mortality under all the chief diseases except small-pox. Cholera was considerably more prevalent than in 1884, and accounted for 173,767 deaths, or 2·62 per 1,000, against 134,421, or 2·03 in 1884. Every district suffered, and more than 12½ per cent. of the villages. In 16 districts the cholera death-rate ranged from 6·87 per 1,000 to 3·06, and in 9 towns it exceeded 10 per 1,000, Sitamurhi and Poori recording 27·91 and 28·76 per 1,000 respectively. The localities chiefly affected were, it is reported, "invariably found to be in an insanitary "condition, especially the villages, the water-supply impure and insufficient, and the "inhabitants frequently disposed to disease, being enfeebled by exposure, insufficient "clothing, and scanty and unwholesome food." The disease was also particularly active at the large religious and other fairs which, in some instances, appears to have been due to defective sanitary precautions. The Army Sanitary Commission notice that the cholera deaths for the five years ending 1885 exceeded those of the previous lustrum by 37,000. "It is quite safe, therefore, to conclude," they say, "that no "effectual measures have been taken to mitigate or remove those local causes which "tell so severely on the fatality of cholera. Indeed, the mortality of 1885 was the "third in order of amount during the 10 years."

Small-pox was much less prevalent than in 1884. It gave rise to 9,863 deaths, or 0·14 per 1,000, against 18,533, or 0·28, and of these more than 75 per cent. occurred amongst children under 12 years of age. The severity of the disease was mainly confined to Patna division, which yielded a little over half the total deaths, viz., 5,161. Gya, Chumparun, and several other districts of this division, where vaccination is very backward, suffered most from the disease.

Under fevers 1,042,142 deaths were recorded, equal to 15·75 per 1,000 of population, against 966,233, or 14·60 in 1884. The increase, in the opinion of the Sanitary Commissioner, was in some measure due to improvement in registration. In 10 districts the recorded fever deaths exceeded 20 per 1,000, Nuddea again coming first; but it is satisfactory to learn that the fatality of the disease in this district has subsided very considerably, viz., from 35·54 per 1,000 in 1881 to 26·85 in 1885. It is also gratifying to notice that in Burdwan and Beerbhoom, which were at one time notoriously fever-stricken districts, there has been a marked improvement. Statistics show that fever deaths are greatly on the increase in Bengal. In 1876 they numbered 561,537, and since then the mortality has nearly doubled, which, "whatever may be "the nature of the fever," the Army Sanitary Commission state, "is a sure test of the "insanitary conditions under which the people live."

The deaths from bowel complaints rose from 58,376, or 0·88 per 1,000, in 1884, to 63,808 or 0·96, but this increase was attributed rather to improving registration than to an increasing severity of prevalence of the diseases, "for the recorded figures," the Sanitary Commissioner remarks, "do not approach even an approximation to the actual "prevalence and fatality of bowel complaints."

The general health of Calcutta was slightly more favourable than in the previous year, and the death-rate declined from 30·59 in 1884 to 29·30 per 1,000 of population. This decrease was chiefly due to the fall in cholera deaths from 2,272 or 5·24 per 1,000 to 1,603 or 3·7. On the other hand, bowel complaints were more fatal, the number of deaths having risen from 1,209, or 2·79 per 1,000, to 1,655, or 3·82; fevers also showed an increased mortality from 3,618, or 8·35 per 1,000, to 3,831, or 8·84; while from small-pox there were only 155 deaths, or 0·36 per 1,000, against 478, or 1·10 in 1884.

Madras.

The results of registration of vital statistics in Madras Presidency during 1885 were less favourable than in the previous year. There were 824,042 births registered, or 3,339 less than in 1884, the ratio per 1,000 of population being the same in both years, namely 29·3. The registered deaths numbered 615,449, or 21·86 per 1,000 against 650,335, or 23·07 in 1884, showing a decrease in 1885 of 34,886 deaths which was accounted for by the great decline in the mortality from cholera and small-pox. As usual there were considerable variations in the birth and death-rates of the different districts. The birth-rates, excluding Madras city, ranged from 16·1 per 1,000 in Nilgiris to 43·5 in Kurnool, and the death-rates ranged from 16·2 per 1,000 in Nellore to 26·3 in Godavari. In Madras town the death-rate was 36·4, or 13 per 1,000 less than in 1884.

Cholera gave rise to 58,109 deaths, or 2·06 per 1,000, against 75,476 or 2·67 in 1884. The disease was more or less prevalent in every district of the Presidency, and was most severe in the first quarter of the year when over half the mortality (36,636) occurred. Out of a total of 51,978 villages only 14 per cent. suffered; and this fact of purely

local prevalence of cholera affords, the Army Sanitary Commission remark, another element in the direction of preventive measures. In some of the towns the mortality was very high, reaching over 10 per 1,000, and these the Commission state, call for prompt inquiry and action; and if they "are under local authorities, it cannot be "predicated of them that they have grappled efficiently with their epidemic predis- "posing causes." The Commission again urge "that a special examination of "exceptional epidemic cases is of great importance to the elucidation of predisposing "causes."

Small-pox deaths fell from 61,247, or 2·17 per 1,000, in 1884 to 34,726, or 1·23. Rather more than half the mortality occurred among children under 12 years of age. The disease again prevailed with special severity in the Godavari district, which returned more than a fourth (8,863) of the total deaths. It is satisfactory to notice the marked diminution in fatal cases in Madras town which has taken place with the introduction of the Compulsory Vaccination Regulation, viz., from 3,997, or 10·2 per 1,000 in 1884 to 25, or 0·06 in 1885.

The deaths from fever amounted to 218,786, or 7·77 per 1,000, against 215,977, or 7·66 in 1884. Fevers were especially numerous in Kurnool, Cuddapah, Vizagapatam, Ganjam, and the Nilgiri districts, which recorded death-rates varying from 16·2 to 10·7 per 1,000. Such cases, the Army Sanitary Commission remark, "obviously should "be dealt with if there were a competent sanitary engineering department to take "them up." As regards the diagnosis of fevers, the Sanitary Commissioner says: "Although every ailment accompanied with a rise of temperature is spoken of by "natives as fever, probably the errors thus introduced into our statistics are "counterbalanced by the failure to register a number of deaths that are undoubtedly "due to fever. The fatal fevers from which the people suffer are almost, without "exception, of a paroxysmal type, and therefore to a great extent an index of the "sanitary state of the country. At the same time it must be stated that in certain "localities, and over large tracts of country, there are abiding malarial influences of "a fluctuating character due to conditions which are hardly under human control."

Deaths from bowel complaints were also more numerous than in 1884, the number being 31,209, or 1·10 per 1,000, against 28,775, or 1·02. As usual, these complaints prevailed more or less in all the districts, but the mortality was greatest in Chingleput, Malabar, South Canara, Nilgiri, and Tinnevelly. "The chief predisposing causes of "bowel complaints," the Sanitary Commissioner (Dr. Farquhar) states, "are general "insanitary conditions, especially bad water and foul air; and the deaths under this head "will no doubt diminish as the sanitary condition of towns and villages is improved."

In Madras city the death-rate for the year was 35·8 per 1,000, or 14·0 less than in 1884. Fevers and bowel complaints, as usual, yielded the most deaths, while from cholera there were only 184 fatal cases, against 1,358 in 1884, and from small-pox there was the enormous decrease from 3,997 to 26 deaths.

Bombay.

Registration of births and deaths in Bombay Presidency during 1885 was attended with satisfactory results, and further progress is expected as the people become familiarised to the system. In 1885 the registered births amounted to 572,431, or 34·79 per 1,000, against 534,723, or 32·50 in 1884. The district rates varied very considerably, but the high average rate for the whole Presidency shows, the Army Sanitary Commission remark, that good work had been done in 1885. The registered deaths numbered 473,591, or 28·78 per 1,000, against 408,409, or 24·82 in 1884, and a decennial mean of 25·58, showing an increase in 1885 of 65,182 deaths which was mainly attributed to improved registration. The mortality among infants and children under five years of age was, as usual, very high, being in the proportion of 42·28 per cent. of the total deaths, a rate which the Sanitary Commissioner, Deputy Surgeon-General Hewlett states, "affords unmistakeable proof of local causes of insanitation "throughout the Presidency."

The deaths from cholera were very numerous, and rose from 13,804, or 0·84 per 1,000 in 1884, to 37,287, or 2·27. Every district was affected, but the severity of the disease was much greater in some areas than in others, notably in the Sind Division, which recorded 11,719 deaths, or 4·85 per 1,000 of population. The outbreaks were, however, strictly local, for only 9 per cent. of the 40,894 villages in the whole Presidency had cholera. "This single fact," the Army Sanitary Commission state, "gives a clue to the whole sanitary method of dealing with cholera, for it shows "conclusively that while the epidemic, as such, was present over the whole country, "its incidence was determined by causes strictly local." This view is borne out by the Sanitary Commissioner, who in his concluding remarks on the cholera history of

the year says: "Putting aside for the present all questions as to the etiology of " cholera, the lesson to be learnt from this epidemic is that all measures taken at the " time of an outbreak of cholera can only be palliative. The real remedy is to insist " on sanitary measures being introduced so as to ensure cleanliness in every village " at all times, irrespective of epidemic times or seasons. If this were only understood " and acted upon, cholera and other diseases would lose their intensity, but nothing " short of this action will prevent epidemics."

The mortality from small-pox was extremely small, only 2,646 deaths, or 0·16 per 1,000, having been registered, against 14,438, or 0·88, in 1884, and a decennial mean rate of 0·49. Small-pox was present in all the districts, but in none in an epidemic form. Of the total deaths, 22 per cent. occurred among infants under one year of age, and 32·7 per cent. among children between the ages of one and 12.

Nearly two-thirds of the total deaths of the year were reported as due to fevers. These numbered 314,237, or 19·10 per 1,000, against 276,989, or 16·83, in 1884, showing an excess of 37,248. The increase was generally distributed, for in all the districts, excepting Upper Sind Frontier, fever caused a higher mortality than in 1884. There was great diversity in the fever death-rates of the several districts; the highest (32·35) was recorded at Broach, and the lowest (8·28) at Ratnagiri. Taking the facts as they stand, they "afford additional proof," the Army Sanitary Commission observe, "if any such were necessary, of the unfavourable local conditions under " which the population is placed."

From bowel complaints also, there was a considerable rise in mortality as compared with previous years, the deaths numbering 45,056, or 2·73 per 1,000, against 35,983, or 2·19, in 1884, and a decennial mean of 34,952, or 2·14. These complaints were universally prevalent, all the districts having recorded deaths, while nearly 20 per cent. of the villages suffered.

The health of the capital during 1885 was fairly good. The deaths numbered 21,850, or 25·88 per 1,000, against 27·29 in 1884. Nearly a third of the year's mortality was registered under fevers, and another third was due to respiratory diseases and phthisis. Cholera contributed 598 deaths, or 22 more than in 1884, and small-pox had only 55 fatal cases.

Punjab.

The general health of the Punjab during 1885 was, on the whole, good. The total births registered were 731,934, or 38·84 per 1,000, being 77,978, or 4·14 per 1,000, less than the number of 1884. This diminution in the birth-rate was general throughout the province, and was attributed by Dr. Bellew, the Sanitary Commissioner, to the injurious effects of the previous unhealthy season. Deaths were registered to the number of 507,140, or 26·91 per 1,000 of population, against 660,298, or 35·04, in 1884. There was thus a decrease of 153,158 deaths during 1885 as compared with the previous year, which was, to a certain extent, due to the healthiness of the year under notice; but the great differences in the death-rates of individual districts, ranging between 13 per 1,000 in Peshawar and 50 per 1,000 in Delhi, point to imperfect registration. The Army Sanitary Commission notice that 73 per cent. of the total mortality " was attributable to diseases of the epidemic and endemic class, affording sure evidence " that the public health is by no means in a satisfactory or safe condition."

Cholera was more prevalent during 1885 than in the previous year, but there were only 1,936 deaths, or 0·10 per 1,000, against 614, or 0·03, in 1884. Ten out of the 31 districts escaped the disease, and the entire mortality took place in less than 1 per cent. of the 35,338 villages. In tracing the history of first cases of this disease, some of the medical officers appear to have attributed them to returning pilgrims from Hurdwar; " but as many districts," the Government of India remark in their orders on the Sanitary Commissioner's report, " such as Delhi, Rohtak, Ludhiana, Ferozepore, " Jullundur, Hoshiarpur, Kangra, &c. (from which large numbers of visitors must " have gone to Hurdwar), escaped with little, if any, cholera between the months of " April and August, this explanation of the introduction of the disease into the " Punjab generally cannot be accepted without reserve." In discussing the cholera history of the year, the Army Sanitary Commission call attention to the sanitary condition of cholera affected localities, " and these," they say, " clearly show that, " with the presence of cholera in the country, there were sufficient local causes in " many affected places to account for the disease outbreaks. . . . The practical " result of another year's experience of cholera in the Punjab appears to be that, " whether an epidemic be intense or not in its activity, the localizing causes are " essentially the same, that they are always active, and that the losses of life are " determined by the epidemic force at the time."

Small-pox, although present in all the districts, was not so virulent as in the previous year, the deaths having fallen from 16,416, or 0·87 per 1,000, to 7,575, or 0·40. Of these, all but 643 occurred among children under 12 years of age. In the district of Lahore the disease prevailed with the greatest severity, and gave rise to 963 deaths, about half of which took place in the city alone, against a mortality of only 8 in the preceding year. Past statistics prove that the excessive mortality in Lahore city had occurred, in accordance with the periodical epidemic revival of the disease. "As a rule," Dr. Bellew says, "vaccination has been always opposed by the "citizens, and its practice has been carried on under many disadvantages. This year, "however, the great mortality having been the subject of comment in the local news-"papers, was thus brought particularly to the notice of the people."

Fevers, as usual, were universally prevalent, and occasioned more than two-thirds of the total mortality of the year. The deaths, however, were not so numerous as in the previous year, the number having fallen from 465,556, or 24·71 per 1,000, in 1884 to 346,763, or 18·40. In some few districts, notably Delhi, Gurgaon, Rohtak, and Karnal, the fever mortality was very severe, and was attributed to unusually heavy rainfall. But, apart from the rainfall, Dr. Bellew states that much of the mortality attendant on fevers was due to the habits of the people themselves, and that until these are materially changed, especially in regard to diet and clothing, he did not expect any great diminution in the death-rate. "It must not, however, be "supposed," the Lieutenant-Governor observes, "that in this will be found any "reason for relaxing our efforts to bring about more satisfactory sanitation than "now exists."

The registered deaths under bowel complaints were 17,711, or 0·94 per 1,000, against 18,346, or 0·97, in 1884. The provincial ratio was exceeded in 10 districts, Simla and Jhelum returning the highest death-rates, viz., 3·26 and 2·15 respectively.

North-Western Provinces and Oudh.

Improvement continues to be made in the registration of vital statistics in the North-Western Provinces and Oudh. In 1885 the registered births numbered 1,819,279, or 41·24 per 1,000 of population, against 1,930,961, or 43·77, in 1884. The public health was much better in 1885 than in the previous year; there was no very serious epidemic of any disease anywhere, and the registered deaths declined from 1,555,342, or 35·26 per 1,000, to 1,410,639, or 31·98. Of these a little less than a half occurred among children under five years of age. The death-rates of individual districts disclosed, as usual, great variations, ranging from 20·56 in Dehra Dun to 54·49 in Bulandshahr, which indicate imperfections in registration. The Army Sanitary Commission notice "that nearly 90 per cent. of the deaths in these provinces "were due to diseases of the epidemic and endemic class, carrying forwards for "another year the conclusion long since arrived at, that the sanitary problem in "India is neither more nor less than the mitigation or prevention of epidemics; in "other words, that it must be dealt with by active and skilled sanitary works and "measures. This has been conclusively shown by the reports of Sanitary Commis-"sioners."

Cholera was more fatal than in 1884, in which year the deaths amounted to 30,143, or 0·68 per 1,000, rising, in 1885, to 63,457, or 1·44. All the 49 districts in the provinces suffered, though some of them were but slightly affected. That the attacks were local is shown by the fact that the entire mortality was yielded by less than 6½ per cent. of the total 105,421 villages. The Sanitary Commissioner (Mr. Planck) has furnished a statement showing the cholera mortality in each district for the last 16 years. From this it is seen that in the 11 districts forming the western portion of the Doab cholera has never been seriously epidemic, their mean death-rate for 16 years being only 4·4 per 1,000 of population; while the three districts (Saharanpur, Muzaffarnagar, and Meerut) forming the Upper Doab is the land of greatest freedom, the mean death-rate being only 2·3 per 1,000. The statement also shows that the country of greatest suffering is that comprising the six districts of Gorakpur-Basti, Gonda, Bahraich, Kheri, Pilibhit, and Tarai, which skirt the Himalayas, with a mean cholera death-rate of 36·5 per 1,000. "We have here," the Army Sanitary Commission remark, "a very interesting topographical fact as regards cholera, namely, that "in the epidemic region of these provinces there are parts whose aggregate mortality, "during a period of 16 years, has been sixteenfold the death-rate of other parts in "the same region. The facts would appear to point to local causes or to topographical "conditions as having influenced the death-rate; but they also suggest further inquiry "under both heads."

The mortality from small-pox was considerably less than in 1884, the deaths having fallen from 202,541, or 4·5 per 1,000, to 14,593, or 0·33, in 1885. These were scattered over all the districts excepting Meerut, which again escaped the disease, its exemption being attributed to vaccination. Of the total villages only 7 per cent. yielded deaths. The disease was most severe in the three central districts of Oudh, viz., Lucknow, Rae Bareli, and Bara Banki, which returned death-rates of 1·56, 2·39, and 1·19 respectively. Of the total small-pox deaths, 3,712 occurred among children under one year of age, and 6,282 between the ages of one and 12.

Nearly 80 per cent. of the year's mortality was registered under fevers. The deaths numbered 1,124,150, or 25·48 per 1,000, against 1,074,097, or 24·35, in 1884. The districts which suffered most were Bulandshahr, Moradabad, Meerut, and Budaun, with death-rates varying from 52·53 to 40·24 per 1,000. Almost the whole of the increase of 50,053 fever deaths occurred in 12 irrigated districts, nine of which belong to the Upper Doab and three to the Rohilkund division, and during the last four months of the year. This Mr. Planck accounted for in the fact that the rainfall in the nine Doab districts was nearly 10 inches above the average. During the year a special inquiry was made by Dr. Sweeney, Deputy Sanitary Commissioner, of the first circle, in regard to the connexion between rainfall, canal irrigation, and fever, when he found that the causes influencing fever arose from the increased moisture of the subsoil, due partly to canal irrigation, but chiefly to the arrest of rainfall drainage, owing to the construction in recent years of a network of earthworks for the realization of irrigation channels, roadways, and railways. His investigation also led him to believe that only when and wherever the abnormal rise of the spring level reaches to within 6 or 8 feet of the earth's surface does it influence the public health as a cause of excessive fever prevalence and death. As an illustration of the results of irrigation without drainage, Mr. Planck instances the case of Shamli town, as taken from a report from the executive engineer of the Eastern Jumna Canal, dated 25th November 1885. That officer says: "When there was no canal, when the country was dry and "parched all round, when higher fields were kept green by water drawn up in bags "from a depth of 30 and sometimes 50 feet, then Shamli was a pleasant city in a "green valley. Feverish indeed and sometimes heavily stricken with ague, but still "a green place and fertile, where shady groves and orchards abounded, and fruits and "herbs grew plentifully. Then Shamli was in a place where a town should be. But "now that water is plentiful everywhere and the ground is sodden, the green valley "has become a noisome fever hole, and the town is but a crumbling ruin." Further, the people are described as sterile and dying out. Steps have since been taken with a view to improving the drainage of the place.

The reported deaths from bowel complaints amounted to 64,409, or 1·46 per 1,000, against 76,508, or 1·73, in 1884. That the mortality of 1885 under this head should be less than that of the previous year, considering that 1885 was a year of heavy cholera mortality, which is generally characterised by an increased prevalence of bowel diseases, seems strange. By districts the mortality ranged from 0·8 in Jaunpur, to 10·45 in Garhwal. The returns, however, for many districts are doubted, and the Lieutenant-Governor has directed that local authorities should endeavour to improve them.

Central Provinces.

The vital statistics of the Central Provinces are reported to be fairly accurate. The number of births registered in 1885 was 399,971, or 45·36 per 1,000 of population, against 368,086, or 41·75, in 1884. In all the districts, excepting Chhindwara and Seoni, where severe epidemics of fever prevailed, births were more numerous than deaths, the average excess being 11·15 per 1,000. The year, however, was not healthy, and the deaths rose from 240,714, or 27·30 per 1,000, to 301,684, or 34·21, nearly a half being children under five years of age.

Of the chief diseases, cholera was unusually prevalent and yielded 21,868 deaths, or 2·48 per 1,000, against only 149 in 1884. The disease visited all the districts excepting Chhindwara, but the entire mortality was recorded from 7·6 per cent. of the total 27,765 villages. It was most fatal in Raipur district which registered a death-rate of 7·70 per 1,000. In discussing the cholera history of the year, the Army Sanitary Commission notice the immunity of the town of Jubbulpore, which recorded only 5 deaths, whereas the district had a mortality of 2·63 per 1,000. The town, for some years had been remarkably free from cholera, and this the Sanitary Commissioner, Dr. J. H. Loeh, attributed to the excellent conservancy arrangements, and to improved water-supply. "This case," the Army Sanitary Commission observe, "may be safely "accepted as showing what may be done with the dense population of an Indian city "in the way of protection from cholera. But it may be safely predicted that immunity

" will be continued only so long as close attention on the part of the municipality is " directed not only to preserving the ground already gained but to extending it, for " so long as the drainage and private latrines are defective, it cannot be averred that " the public health is free from danger."

Small-pox contributed 3,364 deaths, or 0·38 per 1,000, against 4,882, or 0·55, in 1884. The disease prevailed more or less in all the districts excepting Nimar, but only three recorded death-rates of over 1 per 1,000. More than 41 per cent. (1,393) of the deaths occurred among children under one year of age.

Fevers prevailed with great severity, yielding 170,634 deaths, or 19·35 per 1,000, against 145,342, or 16·48 in 1884. In the present state of fever diagnosis, however, little reliance can be placed on the figures, for an investigation into a number of cases showed that death was due to other causes. The Chief Commissioner of the province has directed civil surgeons to give this matter their attention with a view to studying the disease and combating it in every way.

Bowel complaints are reported to have caused 27,455 deaths, or 3·11 per 1,000, against 21,991, or 2·49, in 1884. As usual, the highest district death-rate was that of Sambalpur viz., 9·31. Several inquiries have from time to time been made into the high mortality of this district, and from post-mortem examinations made during 1885, Dr. Loch reported that dysentery was extremely prevalent. The Army Sanitary Commission think it highly probable that unwholesome water may be the cause of the dysenteric cases, and they recommend an investigation into the facts, and that means be taken to improve the supply if necessary. This recommendation has been specially brought to the notice of the Government of India.

The vital statistics of Berar, the Sanitary Commissioner, Dr. Little, states, are not far removed from the truth, and may be accepted as fairly representing the birth and death rates of the province. During 1885 there were 112,781 births registered, or 42·9 per 1,000 of population, which is the highest ratio ever reached since the introduction of birth registration into the province in 1868, and 4,056, or 1·6 per 1,000, in excess of 1884. The district birth-rates varied from 39·2 in Akola to 47·8 in Buldana.

The year on the whole was unhealthy, and the deaths rose from 64,808, or 24·63 per 1,000, in 1884 to 89,558, or 34·05, though to some extent the increase was due to improved registration. More than half the deaths occurred among children under five years of age.

Cholera prevailed much more extensively than in the previous year, the deaths having increased from 87, or 0·03 per 1,000, to 3,683, or 1·40, in 1885. All the districts were more or less affected, but the entire mortality was recorded from 7 per cent. of the total 5,518 villages. Although the year was one of epidemic prevalence, it was not one of intense incidence. The mortality was greater in the towns (2·0 per 1,000) than in the districts (1·4), and in some of the former it was very high, especially in Balapur (7·7), Barsi Takli (9·1), Akola (10·1), and Pusad (11·5). The Army Sanitary Commission notice in particular the case of Akola town, where the death-rate was six times higher than that of the whole district, viz., 1·7 per 1,000. In 1883, when cholera prevailed very severely in the province, the death-rate of the town was 2 per 1,000 against a district rate of 9·7. It appears that for a series of years, since 1868, cholera had always been higher in the town than in the district, and the only explanation given for the diminution in 1883, is that the use of the river water for drinking and domestic purposes was prohibited, whereas in 1885, owing to the unpopularity of the measure it was not enforced. " In " the light of these facts," Dr. Little states, " and apart from any theory of water " contamination, it would be a proper and practical precaution to prohibit the use of " the river water for domestic purposes in future outbreaks." With reference to this case the Commission remark, " that one year's data would scarcely warrant us in " deciding against the use of river water. In the first place, it is one of the unexplained " properties of cholera that it may leave towns and districts within epidemic areas " almost free for years, and nevertheless it may sweep down on them without warning, " and cause great loss of life."

Only 259 deaths, or 0·09 per 1,000, were registered from small-pox against 615, or 0·23, in 1884. The disease visited all the districts, but nowhere in an epidemic form. Its attacks, however, were as usual purely local, for only 70 of the 5,518 villages returned deaths.

Deaths were registered under fevers to the number of 37,339, or 14·19 per 1,000, against 30,551, or 11·60, in the previous year. That these numbers embrace many

deaths from other causes accompanied by febrile symptoms is shown by the fact that in two villages in Wun district, all the 26 deaths were registered under fevers, whereas the results of an inquiry showed that only 8 were found to have been due to fevers.

Bowel complaints yielded a mortality of 15,785, or 6·00 per 1,000, against 9,319, or 3·56, in 1884. Of the six districts of the province, Ellichpur suffered the highest mortality (10·8 per 1,000), and Wun the lowest (1·3).

Assam.

Progress, though slow, continues to be made in Assam in the registration of vital statistics. Exclusive of tea plantations, 126,566 births were registered during 1885, equivalent to 27·95 per 1,000 of population, against 120,447, or 26·60, in 1884. The district ratios varied from 22·48 in Darrang to 37·55 in Goalpara, and 38·84 in Cachar. The registered deaths in 1885 were 126,344, or 27·91 per 1,000, being a decrease of 6,591, or 1·45 per 1,000, on the number of 1884. In tea plantations, among 289,977 coolies, 9,235 births were registered, or in the proportion of 31·84 per 1,000, against 31·66 in 1884, and the deaths amounted to 10,295, or 35·50, against 40·91. "These figures," the Sanitary Commissioner, Dr. Eteson, says, "may be accepted as "approximately correct, having been obtained from the registers of the current year "submitted to the district officers." The smallness of the coolie birth-rate as compared with the mortality was attributed to the deficiency of women among the garden labourers, than would obtain in ordinary communities. "The lower rate of "mortality which has been recorded among this class of the population in 1885," Dr. Eteson writes, "is merely in harmony with the healthy character of the year all "over the province. I have had further opportunity of seeing the conditions under "which the immigrants are placed, and there can be no reasonable doubt but that "these are very variable. In many gardens the management is concerned to provide "all sanitary improvements, regardless of cost, under fully qualified medical advice; "in many others the tendency is not to interfere with the prejudices of the natives, "and to take things as they come. But, on the whole, there is substantial progress, "and the more light there is thrown on the subject the better prospect for the health "of the labourer and the welfare of the property."

The year's statistics show a marked decrease in cholera mortality. "There has been no such lull," Dr. Eteson states, "since the years 1880 and 1881." It is satisfactory to note that this immunity extended also to the immigrant coolies at Dhubri and at Goalunda. The total deaths numbered 7,753, or 1·71 per 1,000, against 22,273, or 4·92, in 1884. All the districts were affected, but less than 12 per cent. of the 16,237 villages returned deaths.

From small-pox also the mortality was remarkably small, the disease, it is reported, never being so rare and so mild during the last five years as in 1885; and only in the Kasi and Jaintia Hills was there any prolonged outbreak. There were 1,980 deaths from the disease, or 0·44 per 1,000 of population, against 4,781, or 1·05, in 1884. About a sixth of this mortality (325, or 7·51 per 1,000) took place in the Khási Hills, which is attributed to the "unconquerable aversion with which vaccination is regarded "by some of the tribes." On the other hand, the immunity of the remaining districts, the highest death-rate returned being 0·97 in Goalpara, was said to be due to the extension of vaccination.

More than a half of the mortality of the year was due to fevers, the deaths numbering 72,482, or 16·01 per 1,000, against 66,514, or 14·69, in 1884. Everywhere there was an increase, but most markedly in Sylhet. Throughout the whole province fever is stated to be endemic rather than epidemic. "There is no epidemic prevalence," Dr. Eteson states, "but a steady mortality from year's end to year's end. "Fever is, in fact, the disease from which the bulk of the population die at all ages, "and at all seasons."

From bowel complaints the registered deaths rose from 16,153, or 3·56 per 1,000, in 1884, to 19,396, or 4·29. Little appears to be known, however, of the actual nature of the mortality. "Probably," Dr. Eteson says, "the general diagnosis is so un-"reliable that comment is practically useless."

Lower Burma.

A new system of recording vital statistics was introduced in most of the districts of Lower Burma in 1884, and was in force throughout the province in 1885. The returns bear indications of improvement, though the variations, both in the birth and death rates of individual districts, show that the statistics are still very inaccurate. The registered births in 1885 were 93,223, or 25·51 per 1,000 of population, against 82,783, or 22·06, in 1884, and the deaths numbered 72,672, or 19·89, against 69,234, or 18·95. The birth-rate of the province was made up of extremes varying from

16·60 in Toungoo to 24·19 in Tharrawaddy, and the death-rate was a mean of district ratios, ranging from 11·64 in Tavoy to 28·16 in Thayetmyo.

Cholera prevailed more extensively than in any year since 1873, and yielded 7,685 deaths, or 2·10 per 1,000, against 5,515, or 1·51 in 1884, proving, the Army Sanitary Commission state, that "any sanitary measures which may have been adopted, have "failed to reach the localizing causes." All the 16 districts, and each of the 20 towns recorded deaths, but the entire mortality was returned from less than 1½ per cent. of the total 14,811 villages.

Small-pox was considerably less prevalent than in the previous year, the deaths numbering 2,120, or 0·58 per 1,000, against 6,102, or 1·67. Children under one year of age contributed 348 of the year's deaths, and among those between one and 12 years there were 1,392 deaths.

Fevers gave rise to 34,070 deaths, equivalent to 9·32 per 1,000 of population, against 29,514, or 8·08, in 1884. The latter half of the year, when the rainfall was heaviest, was the most fatal, over 60 per cent. of the total fever deaths having occurred during that period. "February, March, and April," the Sanitary Commissioner, Mr. Sinclair, states, "during which the rainfall was very insignificant, and the lowest average "humidity, the highest temperature, and the greatest range were experienced, was "the least feverish quarter; on the other hand, August, September, and October, "with most of these meteorological conditions reversed, was the most feverish."

The number of deaths registered under bowel complaints was 3,254, or 0·89 per 1,000, against 3,719, or 1·02, in 1884. Nearly a half of this mortality took place between June and September, when fruit was plentiful and cheap.

IV.—JAILS.

JUDGED by the death statistics, the health of the jail population of India in 1885 was not, on the whole, so good as in the previous year. The admissions and daily sick rates were slightly less, but the death-rate, which had been steadily declining, rose from 29·11 per 1,000 of average strength in 1884 to 33·54. This increased mortality was mainly due to cholera and bowel complaints, though under these heads the death-rates were lower than in any year excepting 1883 and 1884. Sickness and mortality in 1885.

The following statement shows the sickness and mortality among the prisoners of the several provinces and in India, as a whole, for the years 1884 and 1885:—

PROVINCES.	1885.			1884.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal - - - -	1,485	52	59·75	1,420	50	50·41
Madras - - - -	705	25	17·86	765	29	20·55
Bombay - - - -	645	25	33·76	702	26	34·91
Punjab - - - -	1,000	25	27·13	1,131	27	28·04
North-Western Provinces and Oudh	743	28	21·64	681	26	20·86
Central Provinces - - -	983	38	74·33	932	32	42·02
Berar - - - -	549	13	19·14	486	11	8·72
Assam - - - -	2,217	67	61·60	2,109	56	61·19
Lower Burma - - -	869	39	43·15	936	37	30·28
India - - - -	1,017	36	33·54	1,025	37	29·11

It will be seen from the above that the jails of Assam were the most unhealthy, and that those of Madras and Berar were the most healthy. In point of mortality, however, the Central Provinces jails come first, which, as stated further on, was mainly due to the incidence of cholera in the Raipur jail, and to the prevalence of bowel complaints in most of the jails of the provinces.

The general health of the jail population of Bengal during 1885 was not so good as in the previous year, the admissions into hospital having risen from 1,420 per 1,000 of average strength to 1,485, and the death-rate from 50·41 to 59·75. This large increase in the mortality was largely due to the greater unhealthiness of the year, aggravated by severe cholera epidemics, which alone accounted for 10·3 per 1,000 of the jail mortality. Bengal.

In discussing the sanitary history of prisoners, the Inspector-General demurs both to the usefulness and fairness of a comparison between Bengal jails and those of other provinces, for the reason that the climatic conditions are so absolutely different, and that in the vast province of Lower Bengal there are far greater variations between different districts than exist in other provinces in respect of salubrity of climate, and the general health and sanitary conditions of the population from which the prisoners come. His main conclusions are the following: (1) that the most potent of all causes of mortality is the broken down constitution of the prisoners admitted to jails in unhealthy districts; (2) that jail mortality is not due to any causes connected with jail life, as is clear from the fact that a very large proportion of the prisoners die within the first six months of their incarceration, and their chances of life improve after that period; and (3) that it is a mistake to calculate the death-rate on the daily average number confined in jails, when so many of them are admitted in bad and indifferent health, the results in such cases being useless as a means of ascertaining the sanitary condition of a jail. The Lieut.-Governor believes these conclusions to be correct in the main. "There cannot, he thinks," it is reported, "be a doubt, that the condition of health of "the free population must largely influence the death-rate in our jails. At first, it is "possible that the conditions attaching to jail life have a depressing effect, and that "this is intensified by the sickly state of many of the prisoners when they first come "in. But this has nothing to do with jail management, or with the arrangements "made to reduce to a minimum the risks incidental to a state of enforced restraint, "and the Lieutenant-Governor can only repeat what he said last year, that it is

" rather to unremitting watchfulness and care on the part of the jail officials in " carrying out the various arrangements for the well-being of the prisoners than in " any further additions to, or improvements in, the jails, that we must look for a " reduction in the mortality."

Of the total 887 deaths among all classes of prisoners, 838, or 60·9 per 1,000 of average strength, took place among convicts, against 691, or 50·4, in 1884. Of these 34·99 per cent. were admitted in indifferent health, and 30·14 in bad health; and 364 had been less than six months in jail, and 210 more than six months but less than a year. As has been already stated, the year was an unhealthy one as regards fevers, owing to the unusual rainfall during the unhealthy months, and there was a considerable increase in convict admissions to hospital. The admissions from dysentery and diarrhœa were greater, and the deaths rose from 271 to 318. Cholera prevailed in 17 jails, and there were 249 cases with 147 deaths against 57 deaths in 1884.

Twenty-one jails returned higher death-rates than in the previous year, and in the following jails the mortality exceeded the general rate:—

	1885.	1884.		1885.	1884.
Julpigoree	202·0	162·6	Chumparun	81·4	18·9
Hazaribagh	180·8	45·4	Chittagong	80·3	43·8
Dinagepore	170·3	79·7	Mymensingh	70·8	153·0
Rajshahye, *District* and *Central*	169·5	110·8	Khoolna	66·8	16·6
Purneah	133·1	115·3	Manbhoom	64·6	11·8
Rungpore	119·0	283·4	Bhagulpore, *District*	64·5	71·5
Monghyr	111·0	66·3	Maldah	63·6	29·8
Burdwan	92·7	80·7	Alipore, *District* and *Central*	61·9	51·1
Singbhoom	90·6	102·2	Beerbhoom	61·2	23·3
Bogra	83·3	134·5	Darjeeling	59·9	32·4

The high death-rates of Julpigoree, Dinagepore, Purneah, Rungpore, Burdwan, Singbhoom, and Bogra, which are situated in extremely unhealthy districts, were mainly attributed to the unhealthy condition of the people admitted to them, and to the prevalence of malarious diseases in the stations in which these jails are situated. The high mortality at Hazaribagh was due to a very severe outbreak of cholera and to the deaths of 21 men admitted in bad or indifferent health; and at Chumparun and Mymensingh, in both of which special inquiries have been instituted, the districts are also notoriously unhealthy.

Madras.

The prison population of the Madras Presidency in 1885 enjoyed exceptionally good health, as both the admission and death-rates, which were 705 and 17·86 per 1,000 of average strength respectively, were lower than in any other year on record. In six jails there were no deaths, in 13 the mortality was under 20 per 1,000, and in 10 under 40 per 1,000; while only at the Berhampore, Calicut, and Nellore jails, did the mortality exceed 40 per 1,000. With the exception of Trichinopoly, Kurnool, Cuddalore, and Parvatipur, the other jails were free from cholera; but at these four there were only 7 cases, with 3 deaths, against a total of 9 deaths in 1884. This is satisfactory, considering that cholera was prevalent during the year in the Presidency. As usual, the chief causes of sickness were paroxysmal fevers, dysentery and diarrhœa, anæmia and general debility, and respiratory diseases, but these were much less prevalent than in 1884. In all the jails but two, there were some cases of paroxysmal fevers. "Taking into account the excellent sanitary condition of jails," the Sanitary Commissioner remarks, "the occurrence of malarial fevers amongst " the prisoners year after year to such an extent would seem to indicate that the " causes, if local, must be sought for outside the jail premises."

Out of a total of 162 deaths, 128 occurred among convicts, or in the ratio of 17·06 per 1,000 of average strength, against 20·70 in 1884. In 1884 the mortality with regard to length of residence in jail was highest amongst convicts between six and twelve months in prison, but in 1885 it was greatest among those above seven years in jail.

Bombay.

On the whole the health of prisoners in the Bombay Presidency during 1885 was slightly better than in the previous year. The admissions to hospitals were in the ratio of 645 per 1,000 of average strength against 702 in 1884, and the death-rate

33·76 against 34·91. In 5 jails out of 28 there were no deaths, in 6 the mortality ranged from 10 to 20 per 1,000, in 7 from 20 to 30, and in 9 above 30 per 1,000. As usual, the mortality in the Sind jails was much higher than in the rest of the Presidency. The jails in Bombay City, the Yerrowda jail, and the Bijapur gang, were above the average in point of health. In the Presidency proper, the most unhealthy jails were those of Ahmedabad, Thana, Surat, and Nasik. The average death-rate of the jails in the Presidency proper equalled 27·6 per 1,000; while that of the Sind jails was just twice as high, viz., 55·2. Still there was a considerable decrease in Sind as compared with the previous year, when the death-rate (67·8) was more than three times greater than the rest of the Presidency (20·6). The Nara Gang was again very unhealthy, and the death-rate rose from 107·9 per 1,000 in 1884 to 120·0. The high mortality of 1884 was put down to the destruction of the jail by fire, and consequent exposure of the prisoners, on two occasions. During 1885 special precautions were taken against the effects of cold, but to no purpose. The Inspector-General proposes in future to transfer all sick and weakly men from Nara before the cold weather sets in, so that only strong healthy men should be left there in the winter months; other measures have also been proposed, which will no doubt prove beneficial. "But the health of the "prisoners," the Bombay Government has directed "must be most carefully watched, "and an effort must be made to ascertain beyond doubt the causes of the exceptional "mortality." The chief diseases from which the prisoners suffered were intermittent fever, respiratory diseases, and dysentery and diarrhœa, the two latter being the most fatal. From cholera there were 20 deaths, against 4 in the previous year. Of these 11 occurred among the convicts at Thana and 3 at Nasik where the disease was very prevalent for some time during the year, though the prisoners suffered much less than the free population.

All the deaths but 8 occurred among the convict class, yielding a death-rate of 34·7 per 1,000 against 35·0 in 1884.

Punjab.

The vital statistics of prisoners in the Punjab during 1885 were again favourable, and the mortality was lower than in any year since 1868. The admissions to hospital per 1,000 of average strength fell from 1,131 in 1884 to 1,000, the daily sick from 27 to 25, and the death-rate from 28·04 to 27·18. Among the convicts the mortality was in the ratio of 28·07 per 1,000, against 28·87 in 1884. More than a half of the total admissions were due to fevers, but they show a considerable decrease compared with the previous year, and the deaths were 35, or 17 less. Dysentery and diarrhœa yielded 43 deaths, or 22 less than in 1884; on the other hand there was a very marked increase both in the admissions and deaths from respiratory diseases, which rose from 479 and 89 respectively to 625 and 103. Of these, 77 occurred at four jails, viz., Chinawan 33, Lahore Central 19, Delhi 14, and Mooltan 11. Excluding these four jails, the mortality from respiratory diseases would have been much less than in 1884. No fewer than 93 of these 103 deaths were due to pneumonia. "This is one of the "most frequent causes," the Inspector-General says, "if not *the* most frequent cause, "of death in the jails of this province in years when there is no epidemic of infectious "disease. As it occurs in jails, it is of a most fatal character, killing on an average "one out of every 2·5 prisoners attacked, according to the statistics of the last 10 years." The Inspector-General considers that the most exciting cause of pneumonia is chill, but he has little doubt that malarious fever is a most powerfully predisposing cause, just as it is in the case of diarrhœa, dysentery, and anæmia. And as the mortality of the jails is principally due to these diseases, any reduction must be made, he states, by combating the malarious fever which increases the susceptibility to them. As in the three previous years the jails were free from cholera. The statistics of individual jails show that 8 had no deaths, and that in 9 the mortality was low, ranging from 5·05 to 15·87 per 1,000 of average strength. The most unhealthy jail was Delhi, with a death-rate of 82·69, or 8·28 per 1,000 more than in 1884. Amritsar came next with 59·52, and Lahore Female Jail with 56·74. The death-rate in the city of Delhi, which is close to the jail, was 42 per 1,000, and that of the district 54 per 1,000 of population. Steps were being taken for providing the jail with a better water-supply, and otherwise improving its sanitary condition, and it is hoped that an improvement in the health of the prisoners will ensue.

North-Western Provinces and Oudh.

In the jails of the North-Western Provinces and Oudh the health of the prisoners in 1885 was not so good as in the previous year. Though the population was less, the admissions to hospital rose from 681 per 1,000 of average strength to 743, and the death-

rate from 20·96 to 21·64. Of the chief diseases, cholera was present only in the central jails of Fategarh and Benares, and the sickly jail of Gorakhpur, and carried off nine victims. From dysentery and diarrhœa the deaths decreased from 142 in 1884 to 121, and fevers yielded 50 fatal cases. Of the total 432 deaths 400 occurred among convicts, being in the ratio of 21·87 per 1,000 of average strength. In eight jails the mortality exceeded 40 per 1,000, Meerut Central jail heading the list with a death-rate of 81 per 1,000. Owing to the continued unhealthiness of this jail, it has been decided to close it when the building operations at Fatehgarh and Bareilly, which were being vigorously prosecuted with the view of accommodating the Meerut prisoners, are completed. The high death-rate at Meerut jail was ascribed to the inmates being composed mostly of old and weakly men, all the vigorous and able bodied prisoners having been transferred to jails where building operations were in progress. In Moradabad and Gorakhpur, notwithstanding the adoption of special precautions, the death-rates continued abnormally high, viz., 58·64 and 64·83 per 1,000 respectively. It is reported that the accommodation of the jails was much above the temporary requirements of the year, and that most of the jails were comparatively empty. "The question of how to make "a prison healthy," the Inspector-General remarks, "is one which is for ever being "debated. The evils of site-crowding and prisoner-crowding are being constantly "exposed, and are set forth in the last report of the Army Sanitary Commission. In "the year under review (1885) there was no crowding anywhere." Statistics show that the worst results are obtained from the second and third class jails, with an average population for 10 years varying from 300 to 500, and from 150 to 300 respectively. "These classes," the Inspector-General says, "contain certain jails where, above all, "a large proportion of prisoners are received on admission in a low and anæmic "condition; and I think that in most cases, with a few notable exceptions, the real "explanation of high sick and mortality rates is to be found in the general state of "health of the surrounding and free population. Where anæmia and debility follow "on prostration from fever, death-rates will be high."

Central Provinces.

The results in the jails of the Central Provinces for 1885 were very unsatisfactory. The admissions into hospital were more numerous than in the previous year, being in the ratio of 983 per 1,000 of average strength, against 932 in 1884, and the death-rate 74·33, against 42·02. The chief diseases among those treated were dysentery and diarrhœa, intermittent fever, ulcers and boils, and anæmia and general debility. Of the total 255 deaths, 248, or 77·26 per 1,000 of average strength, occurred among convicts, and of these 87 were due to dysentery and diarrhœa, 60 to anæmia and general debility, and 53 to cholera. All the cholera cases, except one, and all the deaths from cholera, occurred in the Raipur jail. The average mortality in the district jails was very little in excess of that of the previous year, and the increase of deaths was mainly confined to the three central jails of Nagpur, Jubbulpore, and Raipur. In the first of these three the convict deaths rose from 51 to 69 per 1,000, the increase being attributed by the medical officer to the unusual number of old men in jail; but in the opinion of the Inspector-General the true cause was the abnormal unhealthiness of the season. At Jubbulpore the death-rate rose from 38 to 95 per 1,000; and of the probable causes of this increase, the chief were, it is stated, "a wet subsoil" and an "epidemic influence"; but "over and above these, however," the medical officer says, "there is the accumulation of weakly prisoners consequent on a succession of three or "four healthy years." The defect in the subsoil drainage of this jail is, it is reported, being rectified so far as possible, by a system of open drains dug to a depth of from 7 to 10 feet. As regards the Raipur jail, an epidemic of cholera accounted for the increase in the death-rate from 58 per 1,000 in 1884 to 153 in 1885. A special enquiry into the outbreak of this epidemic was made by the Deputy-Surgeon-General, under the orders of the Chief Commissioner, but his report has not yet been received.

Berar.

The jails of Berar were more unhealthy in 1885 than in the previous year. The number of deaths rose from 9, or 8·72 per 1,000 of average strength in 1884 to 20, or 19·1; and while in 1884 all the deaths were recorded at one jail, Akola, four out of the six jails in the province registered deaths in 1885. This increased mortality, in the opinion of the jail authorities, was due to the greater unhealthiness of the general population, and not to any cause connected with neglect of sanitary precautions, or to deficient food. The chief diseases were remittent and other fevers and respiratory diseases. Sixteen of the total 20 deaths occurred at the two central jails of Amraoti and Akola, the former returning 6 and the latter 10 deaths. There were only two cases of cholera which took place at Amraoti jail, and one of these terminated fatally. In

some of the district jails there was overcrowding, especially in the Buldana jail, which was to some extent met by means of tents in the jail enclosures. "The population of "these jails," the Inspector-General says, "will be watched, and if they continue to "show overcrowding, proposals will be made for enlarging them."

Assam.

There was a small increase in sickness and mortality in the Assam jails during 1885 as compared with the previous year, the admissions to hospital having risen from 2,109 per 1,000 to 2,217, and the death-rate from 61·49 to 61·60 per 1,000 of average strength. In all, the deaths numbered 85, or one more than in 1884, and of these, 77 occurred among the convicts, 34 being due to dysentery and diarrhœa, 12 to anæmia and general debility, 8 to respiratory diseases, and 6 to cholera. Forty-five of the convict deaths occurred in the jails of Sylhet (21, or 94·11), Dibrugarh (12, or 176·49), and Gauhati (12, or 78·13) With regard to the high mortality in the Dibrugarh jail, which was nearly 60 per 1,000 in excess of 1884, the superintendent says: "Five "men died from cholera, not one of whom had spent a month in jail; others were "admitted to hospital only a few days after admission into jail and never recovered; "and one man committed suicide by dropping into a well within the jail enclosure." This jail appears also to have been overcrowded for the greater part of the year, which probably had some effect on the health of the prisoners, and to this matter the Local Government have called attention, stating that it must not again be permitted.

Lower Burma.

The sanitary history of the jails of Lower Burma during 1885 was unfavourable. In the ratio of admission to hospital there was a slight decrease, but the ratio of daily average sick increased from 37 in 1884 to 39, and the death-rate from 30·28 to 43·15 per 1,000 of average strength. Amongst all classes of prisoners, the deaths numbered 295, of which 61 were due to cholera, 86 to bowel complaints, and 15 to fevers, against 32, 47, and 8 respectively in the previous year. There were outbreaks of cholera in several jails, the most severe being in the Bassein and Toungoo jails. The former recorded 63 cases and 32 deaths, and the latter 20 cases and 12 deaths. The prisoners from both these jails were removed, soon after the outbreak of the epidemic, to temporary quarters beyond the jail; but in Bassein, where the prisoners were removed only a short distance, cholera cases occurred among those segregated, while in Toungoo, where they were encamped some two miles north of the jail there was no more sickness. Among the convict class of prisoners there were 280 deaths, equal to 42·99 per 1,000 of average strength, and of these no less than 149, or 52 per cent., occurred among convicts who had been less than six months in jail, as against a corresponding percentage of 46 in 1884. "There can be no question," the Inspector-General states, "as urged by most superintendents, that, during 1885, an unusually large number of "very unhealthy convicts was admitted to the jails of the province, and the ratio of "deaths per 1,000 of the average number in prison for less than six months, 82·27, "against 43·80 in 1884, lends support to the view. This, I believe, explains the "increase in the mortality from bowel complaints (36), and anæmia and general "debility (28), which, with the excess mortality from cholera (31), more than accounts "for the rise in the death-rate for 1885 compared with that for the preceding years." The experiment of substituting pulse for fish and meat in the dietary of the prisoners was continued during the year, and proved successful. The prisoners, are said to like it, and it appears to agree with them, as the percentage of those who had lost weight when discharged was smallest in those jails in which pulse was most frequently issued.

V.—VACCINATION.

General results.

In the several provinces of India, excepting Mysore, the statistics of which were not available, 4,703,214 persons were successfully vaccinated by the special vaccination and dispensary establishments during 1885–86. Of these, 1,904,151 were children under one year of age, or about a fourth of the estimated births. The proportions of successful vaccinations per 1,000 of population ranged from 50·79 in Coorg, to 13·46 in Lower Burma, and 13·50 in the North-Western Provinces and Oudh; but in no other provinces was the proportion below 20. The percentage of annual estimated births (at 40 per 1,000 of population) successfully vaccinated was highest in Berar, viz., 75·7, the Punjab coming next with 56·5, Bombay following with 54·9, and the Central Provinces with 40·3, the remainder ranged from 6·8 in Lower Burma to 16·0 in the North-Western Provinces and Oudh.

Bengal.

During 1885–86 the Compulsory Vaccination Act was extended to several towns in Bengal, and the total area under protection embraced a population of 49,299,987, or 1,493,047 more than in 1884–85. The history of the year, however, is not a satisfactory one, as the number of operations fell from 1,488,296 in 1884–85 to 1,368,996, showing a decrease in the year under notice of 119,300, which was attributed principally to a paucity of subjects. But the Government of India did not consider this a valid excuse, for, estimating the births at 40 per 1,000 of population, and allowing for deaths, it is calculated that less than an eighth (213,723) of the available infants (1,735,360) were protected during the year. The total primary vaccinations numbered 1,361,781, and of these 99·23 were successful, against 1,475,502 and 99·38 respectively in 1884–85. The results of operations performed by bovine lymph were not so successful as in the previous year, the failure of the virus being attributed to defects in storing it in tubes. As regards the attitude of the people towards vaccination, it is satisfactory to learn that there was less opposition than formerly, and that many of its most powerful opponents were accepting it. During the year two female vaccinators were employed, one in Calcutta and the other in Joynuggur, in the Metropolitan circles. The out-turn of work of the former was not great, but as the people come to know that a female vaccinator is available, it was thought probable her services might be in greater demand. The female vaccinator of Joynuggur appears to be possessed of some medical knowledge, having attended at the Calcutta Medical College to qualify herself as a midwife; but, being obliged to give up her college career and take to private practice, she came under the notice of Deputy Superintendent Jadub Chunder Ghose, who trained her in vaccination, and she is reported to have given every satisfaction in the discharge of her duties.

Madras.

During the year, 766,479 persons were vaccinated in Madras, against 803,469 in 1884, the falling off being attributed to the great prevalence of small-pox in 1884, when large numbers submitted to the operation, whereas with the decline of the epidemic fewer sought the benefit of the prophylactic in 1885. Primary cases numbered 752,047, of which 94·3 per cent. were successful, against a corresponding percentage in 1884 of 92·6. Of the children under one year of age, only 142,115 were vaccinated, equal to about a sixth of the year's births, and 384,007 cases were children between one and six years. In the face of such facts, the Army Sanitary Commission observe, and considering the epidemic character of small-pox in the Presidency, it seems not out of place to advise a more persistent spread of vaccination at the earlier ages. In the town of Madras vaccination is compulsory, and during the year the operations exceeded the births by 8 per cent. To a great extent this is explained by children from beyond municipal limits having been brought to the town for vaccination. Great difficulty is still experienced in getting good vaccinifers, and no batta, it is reported, will induce mothers to allow lymph to be taken from their children's vaccinated arms. With the view of overcoming this difficulty, animal vaccination was being extended, and was carried on during the year with satisfactory results.

Bombay.

Vaccination work was more vigorously carried on in the Bombay Presidency during 1885–86 than in the previous year. With an accession of 23 vaccinators to the staff of the general vaccination establishment, the number of operations performed rose from 837,163 to 884,780. Including native states and dispensary work, the total vaccinations performed in the Presidency was 905,892, against 865,568 in 1884–85.

Primary cases numbered 854,387, or 52,180 more than in the previous year, with a percentage of success of 95·76, against 95·29. Out of 818,135 successful primary cases, 565,071 were children under one year of age, and 253,927 were between one and six years. Exclusive of native states, the number of infants successfully vaccinated was 363,519, which fell short of the registered births, minus deaths, by 108,303. Still over three-fourths of the children available for vaccination were protected, which is a satisfactory result compared with other provinces. In the great majority of cases human lymph was used either from arm to arm or from tubes; but in several places animal lymph was utilized, and in Bombay no other lymph is used. The Compulsory Vaccination Act has been in force in Bombay City and Karachi for some years, and in both places it is reported to have been effective in the protection of children.

Punjab.

The history of vaccination in the Punjab during 1885–86 is, on the whole, satisfactory. The combined work of all the establishments showed that 612,466 operations were performed, being an increase of 28,968 on the number of the previous year. Of these, 594,367 were primary cases, with a percentage of success of 94·74 against 94·76 in 1884. The great majority of the successful primary vaccinations were infants under one year of age, and equalled about 56 per cent. of the children available for vaccination, estimating the births at 40 per 1,000 of population. The people were still strongly averse to lymph being taken from their childrens' arms, and the prejudice was so high in Lahore, that the vaccination of calves had to be resorted to in order to get a supply of lymph. This experiment was attended with such satisfactory results, that the local government considered it deserving of the attention of all civil surgeons who had not already made it in their own districts. The advantages of vaccination as a protection against small-pox was brought prominently to the notice of the people by the Sanitary Commissioner, in lectures and addresses given during his tour of inspection, and led to the active participation of some of the influential citizens in aiding its progress.

North-Western Provinces and Oudh.

Satisfactory progress was made in vaccination work in the North-Western Provinces and Oudh during 1885. The total number of vaccinations performed was 697,610, against 656,561 in 1884. Of these, 671,716 were primary operations, with 589,018, or 87·69 per cent. successful cases. The protection of children continued very backward, for of infants born during the year, less than a fourth (282,427) of those available for vaccination were operated on. It is satisfactory to learn, that during the year an advance was made in Oudh, where vaccination had hitherto been much less popular than in the neighbouring province, which the Sanitary Commissioner attributed in a great measure to the attentive labours of the deputy superintendent, aided by the district officials. There were also signs that the prevailing prejudices that had stood in the way of its general acceptance were disappearing; still there is much room for improvement as is shown by the mortality from small-pox during the year.

Central Provinces.

The results of vaccination work in the Central Provinces during 1885–86 were generally unsatisfactory. The total operations decreased from 415,804 in 1884–85 to 384,472, though the number of vaccinators employed was the same in both years. Primary cases amounted to 368,571, or 31,704 less than in 1884–85, and the percentage of success declined from 96·30 to 95·62. Of the 352,632 successful primary operations, 174,286 were of infants under one year of age, equal to 40·3 per cent. of the births of the year, estimated at 40 per 1,000, and 156,648 were above one and under six years, together making a total of 330,934 against 359,285 in 1884. These unfavourable results, the Chief Commissioner observes, in his orders on the report, are greatly to be regretted, and "it will require the closest supervision on the part of civil surgeons and "the superintendent to recover the ground which has been lost." The attitude of the people towards vaccination was chiefly one of indifference, though, as a rule, there was no great difficulty in persuading them to let their children be vaccinated; on the other hand, certain classes did all they could to avoid having their children vaccinated, and with these time and patience are necessary.

Berar.

The aggregate number of vaccinations performed by all establishments in Berar, during 1885–86 was 97,654, against 101,134 in the previous year, being a decrease of 3,480. Of these, 97,539 were primary cases, against 100,970, and the ratio of success was 95·4 per cent. as compared with 94·9 in 1884–85. The falling off in operations was ascribed to a number of vaccinators having been employed on cholera duty for varying periods up to three months during the year. The number of children under

one year of age successfully vaccinated was 72,860, or 75·7 per cent. of the births, estimated at 40 per 1,000 of population, against 70,108, or 72·8 in 1884–85. The attitude of the people generally towards vaccination was favourable, "and a vaccinator working with tact and care" the Sanitary Commissioner (Dr. Little) reports, "will seldom meet with any difficulty which his superintendent cannot assist "him in removing." Dr. Little reported favourably of the officers of the Vaccination Department, and regarding the vaccinators, he says, "Considering the difficulties they "often meet with, there is little or no friction between these men and the villagers, "which speaks creditably for the *morale* of the department."

Assam.

During 1885–86 the vaccination establishment of Assam was strengthened by the addition of 40 operators, resulting in an increase in the number of vaccinations from 95,282 in 1884–85 to 115,642 in 1885–86. Besides these, 6,249 operations were carried out by tea-garden agency, bringing the total to 121,891, or 18,160 more than in the previous year. Primary operations numbered 121,174, and of these 89·43 per cent. were successful. Omitting the tea-gardens, the results of which are not very reliable, only 18,952 infants were protected from small-pox throughout the province, equal to about 15 per cent. of the registered births. The attitude of the people as regards vaccination, the Sanitary Commissioner reports, is "in general passive "acquiesence, and, as heretofore, accepted more or less unwillingly. But in some "places the people do seem to understand its protective value, and are growing "accustomed to the regular seasonal visit. There are still considerable sections of "the population who are entirely under the influence of the priesthood, and dare not "be vaccinated even if they wished it. Not a single superintendent mentions his "having received assistance from a native of any rank or education." The Compulsory Vaccination Act was in force in the municipalities of Gauhati, Dibrugarh, and Sylhet, and in the cantonment of Dibrugarh.

Lower Burma

There was a considerable falling off in the work of vaccination in Lower Burma in 1885–86, which was partly due to the comparative immunity which the province, and particularly the large towns, enjoyed from the ravages of small-pox during the year. Including 1,826 dispensary cases, the total number of vaccinations amounted to 65,342 against 90,667 in 1883–84. Of these, 61,789 were primary operations, 50,113, or 83 per cent., being successful. Besides these, 3,421 successful vaccinations were effected under the superintendence of Dr. Vinton, "who," it is reported, "has taught "many, and proposes to teach more, of the Christian Karen schoolmasters in the "Hanthawaddy district how to practice vaccination." Of the successful primary cases, only 10,178 were under one year of age, or about a ninth of the registered births of the year. These facts cannot be regarded with satisfaction; but attempts were being made to improve the service. The Compulsory Vaccination Act was in force at Akyab and Rangoon, and during the year was extended to the town of Moulmein, where "it "may safely be predicted, that its proper enforcement will lead to the saving of "many lives." The prejudice of the people against vaccination appears to be gradually disappearing in the province.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

At the beginning of 1885 there were 230 dispensaries open in Bengal, and in the course of the year seven new ones were established, while four were closed, so that there remained at the end of the year 233. At these there were 985,984 patients under treatment, against 990,632 in 1884, showing a decrease in 1885 of 4,648, which was entirely confined to out-door patients, for the number of in-patients exceeded that of the previous year by 689. Of the 25,776 in-patients under treatment, 13,552 were cured, 4,036 were relieved, and 4,018 died; the death-rate being in the ratio of 155·9 per 1,000 of the total number against 147·5 in 1884. The Inspector-General did not consider the mortality high, though in some institutions the rates were excessive. "The mortality in our dispensaries," he says, "is influenced so largely by the quantity "of moribund and desperate cases which they are forced to receive that, whatever the "varying death-rates may be, they are no measure of the prevailing sickness in "particular places, nor do they help us in any way to elucidate any one point which "death-rates are known to illustrate." The total major operations performed during the year numbered 3,429, or 63 more than in 1884. Of these, 507 were operations connected with the eye, against 367. With regard to the sanitary condition of the various institutions, the Inspector-General observes: "I have been struck with the real "interest in sanitation evinced by the medical officers in charge of the institutions I "have been able to personally inspect during the year, and I have no reason to "question that the same healthful progress obtains generally elsewhere. Some of the "institutions were models of cleanliness. Hygienic arrangements were conducted "systematically and intelligently. Civil surgeons encourage their subordinates in this "direction as in all other professional matters; and, judging from practical results, I "must say their endeavours have met with no mean success." Bengal.

The following statement shows the number of patients under treatment in the medical institutions of Calcutta, including the Howrah General Hospital, and the two voluntary lock hospitals of Sealdah and Alipore:—

Medical Institutions.	1885.				1884.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	5,897	47,149	53,046	104·41*	5,522	44,562	50,084	126·1*
General Hospital	3,417	—	3,417	31·02	3,073	—	3,073	40·33
Mayo Hospital and Dispensaries	2,564	179,208	181,772	110·37	2,451	181,274	183,725	159·52
Campbell Hospital	7,611	—	7,611	212·06	6,525	—	6,525	236·01
Municipal Police Hospital	2,329	—	2,329	12·02	2,221	—	2,221	10·8
Voluntary Lock Hospitals, Calcutta	414	1,889	2,303	43·47	333	1,454	1,787	63·06
Total Calcutta Hospitals	22,232	228,246	250,478	120·23*	20,125	227,290	247,415	139·29*
Howrah General Hospital	1,631	11,518	13,149	199·37	1,568	9,849	11,417	222·57
Grand Total	23,863	239,764	263,627	125·79*	21,693	237,139	258,832	145.46*

* Reckoned on cases treated, exclusive of ophthalmic cases.

It will be seen from the above that there was an increase of 2,625 out-patients and of 2,170 in-patients over the numbers of 1884. The increase in house-patients was chiefly confined to cases of fever, bowel complaints, venereal disease, and diseases of an asthenic type. Among the 23,863 in-patients there were 2,936 deaths, or a rate of 123·03 per 1,000, which is the lowest yet reached. Cholera cases declined from 1,023 in 1884 to 627, and the deaths from 536 to 362; the proportion of deaths to cases was, however, slightly in excess of the ordinary rate. The total number of surgical operations performed during the year was 19,547, of which 1,505 were of the major class against 1,368 in 1884. Cures were effected in 1,063 cases, and 75 were fatal. The Lieutenant-Governor again testifies to the valuable services rendered by the ladies of the Clewer Sisterhood, under whose superintendence the nursing arrangements at the General and Medical College hospitals continue to be conducted.

There were 307 hospitals and dispensaries at work in the Madras Presidency during 1885, against 299 in 1884. The returns show a satisfactory increase in the number both of in-patients and of out-patients, and bear witness to the progress made in the Madras.

gradual extension throughout the Presidency of the benefits of European medical science. The former class of patients rose from 39,826 in 1884 to 40,564, and the latter from 1,714,072 to 1,854,372, showing a total increase of 141,038. Of the in-patients 27,398 were cured, 5,007 were relieved, and 3,095, or 76·3 per 1,000 died, against a mortality of 3,100, or 77·8, in 1884. Among both classes of patients there were fewer admissions from cholera and small-pox than in the previous year, as the epidemics of both were on the decline. Fevers were, as usual, very prevalent, as were also respiratory affections, bowel complaints, and cases of ophthalmia. There was also a considerable increase in the number of cases treated for skin diseases and ulcers, while venereal complaints rose from 50,957 to 55,621. For some years there has been a continuous increase in the number both of major and minor operations. Since 1881 the former kind have risen from 2,572 to 4,365 and the latter from 40,360 to 59,858. Of the major operations performed during 1885, cures were effected in 3,492 cases.

A hospital for the benefit of Hindu and Muhammadan women, whose religious feelings and social obligations prevent them from seeking ordinary medical aid, was founded during the year by a number of influential native gentlemen. The hospital was opened by Lady Grant Duff on the 7th December, and received the name of the "Victoria Hospital" with the permission of Her Majesty the Queen-Empress. The Madras Government have promised it a grant of Rs. 10,000 for the year 1886–87, and have also sanctioned the free supply to it of European medicines up to the end of that year.

Bombay.

In the Bombay Presidency there were 217 civil hospitals and dispensaries open during 1885, nine of which were new, against 208 in the previous year. The total number of patients under treatment was 1,605,968, of whom 37,642 were in-patients. As compared with 1884 there was an increase of 113,558 out-patients and of 1,240 in-patients, the increase being greatly due to the growing popularity of the institutions. Of the in-patients, 27,151 were cured, 4,241 relieved, and 2,791 died, the death-rate being 74 per 1,000 of total treated, against a mortality of 70 per 1,000 in 1884. "In "charitable hospitals in India, as a rule," the Surgeon-General (Dr. Moore) observes, "a high rate of mortality will always be found to prevail. To them come the dregs "of the population nurtured in an atmosphere of disease. To them congregate the "victims of malaria, syphilis, leprosy, scurvy, and every form of zymotic malady, "also of hereditary disease." As usual the three most numerous classes of cases treated were malarious fever, skin diseases, and ophthalmia. Small-pox cases decreased from 1,099 in 1884 to 153, while cholera cases rose from 1,943 to 5,360. With regard to the latter disease, "it may be mentioned," Dr. Moore states, "that whatever "views or theories medical officers hold with regard to the dissemination and origin "of the disease, all are in perfect accord that sanitary measures in their fullest sense "are the great preventive means. . . . . Village sanitation, however, means the "outlay of much money, which neither the inhabitants nor the State can afford to "disburse; and, moreover, there are many towns and villages which, through defects "of site, position, and construction, never could be thoroughly sanitated. The "alternative measure is increased endeavour to instruct the people in the elements of "sanitation and hygiene, which should be persistently taught in the vernacular "schools." The number of major operations performed during the year was 4,068 against 4,182 in 1884. Including 152 cases which remained from the previous year, the total under treatment numbered 4,220, and these were attended with great success, 3,512 being cured, 285 relieved, while 205 died. In the course of the year, Dr. Moore made a careful inspection of a number of the institutions, and he testified to the satisfactory manner in which they were administered; he also made several suggestions with a view to the improvement of certain hospitals, among them being the reconstruction of the European General Hospital on account of its position. This question was under the consideration of the Government.

Punjab.

Two new dispensaries were opened in the Punjab during 1885, and five were closed for want of funds, leaving 193 in operation. There was a decrease in the total number of patients under treatment, as compared with the previous year, of 1,604, the numbers being 1,780,327 and 1,781,931 respectively. The decrease was entirely among out-patients, for the in-patients rose from 39,300 to 40,810, which is a proof of the increasing usefulness and popularity of the dispensaries, the more so as 1885 was a healthier year than 1884. Of the in-patients, 28,007 were cured, 5,654 were relieved, and the deaths amounted to 2,000, or 49·0 per 1,000, against 49·3 in the previous year. Among the different diseases for which patients sought relief, small-pox cases declined from 366 in 1884 to 231, and malarial fever from 369,024 to 317,297; while, on the

other hand, cholera cases rose from 94 to 1,156. The number of ophthalmic cases continued high, viz., 134,145 against 132,307 in 1884; and respiratory diseases also continued to increase, the number of cases being 141,323, or 4,101 more than in 1884. The number of major operations performed was 10,502, against 8,313 in the previous year, or an increase of 2,189.

The treatment and medical training of women received much attention during the year. At Lahore a lying-in hospital under the superintendence of a qualified lady doctor was opened, and steps were being taken for providing that municipality with a suitable hospital for women, a native gentleman having contributed Rs. 15,000 towards the building, and the local government having promised a grant in aid of Rs. 8,000, on the understanding that the balance of the cost is met from private sources. A lying-in hospital has also been opened at Simla in connection with the Ripon hospital. The foundation stone of the general hospital for Delhi, referred to in vol. xviii., p. 28, was laid by the Viceroy on the 2nd of November, 1885, and the building is now in course of construction. A hospital for women, perfectly separate and distinct, with quarters for a lady doctor, forms part of the project.

North-Western Provinces and Oudh.

The number of dispensaries and hospitals open in the North-Western Provinces and Oudh during 1885 was 244, at which there were 47,127 house patients under treatment, against 44,201 in 1884, and 1,889,225 out cases, against 1,693,581, or a total increase in 1885 of 198,570 patients. This large increase was attributed mainly to the continued prevalence of malarious fever. But the year, on the whole, was an unhealthy one, and this is further corroborated by the statistics of mission dispensaries and private institutions, the attendance at the former having increased from 54,168 to 66,338, and in the latter from 44,556 to 74,160. Of the 47,127 in-patients, 27,500 were cured, and 8,300 relieved, while 2,763, or 58 per 1,000 died, against a death-rate of 60 per 1,000 in the previous year. Surgical work continued to progress. Minor operations were performed in 82,457 cases, as compared with 79,529 in 1884, and major operations increased from 14,938 to 15,186, of which 11,742 cases were cured, 1,857 were relieved, and 232 terminated fatally. The number of cataract cases was as large as ever, amounting to 6,417, with a percentage of success of 74, which was 2 per cent. better than the results of 1884. The results, as a whole, of the working of the institutions were very satisfactory, and witness, the Lieutenant-Governor observes, to good management and to the careful and effective supervision of the Inspector-General, as well as to the general zeal and attention of the medical officers.

Central Provinces.

During 1885 there were 83 hospitals and dispensaries open in the Central Provinces, 75 of which were under the control of municipal committees or district councils, leaving eight under the direct control of Government. Besides these there were 16 private dispensaries, which were maintained entirely at the cost of feudatory chiefs or zamindars. Excluding these, the total number of patients under treatment at the 83 institutions was 779,432, against 652,620 in 1884. This shows an increase in 1885 of 126,812 patients, which was mainly due, it is reported, to the growing popularity of the institutions and increased confidence in the medical officers in charge. In-patients numbered 7,330, or 379 more than in the previous year, and of these 4,967 were cured, 602 were relieved, and 906, or 123·6 per 1,000, died, against 624 deaths, or 89·8 per 1,000 in 1884. The increase in the mortality was attributed chiefly to the more careful selection of cases for admission, and the admission to some dispensaries of moribund persons. The year was, on the whole, less healthy than the previous one, and there was an increase in 25 of the 31 groups under which diseases were registered, the increase being most marked in cases of ophthalmia, which yielded a provincial ratio of 26 per 1,000 more than in 1884, and of skin diseases with a higher ratio by 12 per 1,000; while the number of cases of malarious fever was larger by 18,219, though the ratio to total treated under this head was less by 10 per 1,000. Surgical operations continued to increase, those of a major kind numbered 682, an increase of 45 on the previous year, but operations for cataract alone accounted for nearly the whole of the advance. A number of dispensaries was inspected by the Sanitary Commissioner during the year, and he reported favourably of their management.

Berar.

In Berar there were 42 hospitals and dispensaries open during 1885, the same number as in the previous year, and at these 226,652 patients sought relief, or 20,468 more than in 1884. The increase was general throughout the province, and, although the year was an unhealthy one, "the figures," it is stated, "lead to the belief that "year by year the people of the province appreciate the European system of medical

" relief more and more." In-door patients numbered 2,185, against 1,800 in 1884, and of these there were cured 1,950 and 1,567 respectively, equal to 87 per cent. in both years; while 37 per 1,000 died in 1885, against 36 in the previous year. As usual, the chief proportions of admissions of in-patients were due to fevers and injuries, but there was a considerable increase under dysentery and diarrhœa, which the Inspector-General was inclined to attribute to the prevalence of cholera during the year. Among out-patients, ophthalmia and skin diseases were unusually prevalent. The number of major operations performed rose from 299 in 1884 to 320, of which 290 resulted in cure, and 5 were followed by death. The majority of these operations were, however, of a comparatively simple nature, and the Resident at Hyderabad considered the number of operations on the eye (6) surprisingly small for so large a province. Inspection of the institutions was efficiently performed during the year, and certain of the dispensary committees showed much zeal in supervising the working of the dispensaries.

Assam.

There were 47 dispensaries in operation in Assam during 1885, against 39 in 1884, the increase having taken place chiefly in Sylhet. Notwithstanding the greater number of dispensaries, the in-door patients decreased from 3,565 in the previous year to 3,330; while, on the other hand, out-patients rose from 103,571 to 131,058, making a total of 134,388 against 107,136. These results are, on the whole, satisfactory, when it is remembered that in 1880 only 41,763 of the population were aided in sickness. Of the 3,330 in-patients, 1,887 were cured, 208 were relieved, and 676, or 203·0 per 1,000, died, a ratio which is, it is stated, of itself sufficient to drive people away, one patient out of every five having died. The death-rate, however, was slightly more favourable than that of 1884, viz., 212·6. In the plains districts the beds in dispensaries are for the most part occupied by sick and destitute tea-coolies, and by the miserably poor among the indigenous population, and the pauper classes constituted no less than two-thirds of all admissions. Only 1,100 of the 3,330 in-patients were Assamese, against 1,426 out of a total of 3,565 in 1885. The reduced number treated, Dr. Eteson says, " may be due to the specially healthy year, but the evidence is discouraging, although " in Assam there are peculiarities of family and home ties which make life in a " hospital almost unendurable." Surgical operations continue to increase in number and also in importance. There were 254 major operations in 1885 against 187 in 1884; including 6 cases which remained from the previous year, the results were 215 cured, 11 relieved, and 8 died.

Lower Burma.

One new dispensary was opened in Lower Burma during 1885, making a total of 32 in operation. The number of patients treated rose from 169,741 in 1884 to 188,943, the increase being entirely among out-patients, as the in-patients decreased from 13,574 to 11,985. Of the latter class, 8,001 were cured, 820 were relieved, and 1,246, or 103 per 1,000, died, against 1,197 deaths, or about 90 per 1,000, in 1884. Operation work continued to increase, though chiefly in the minor class. Out of 257 major operations, which was an increase of eight on the number of the previous year, 218 were cured and 18 were fatal. " As in former years," it is stated in the Resolution of the Chief Commissioner of the province on the Sanitary Commissioner's report, " Natives of India are found to use dispensaries to a much greater extent than " Burmans, who contribute only about one-half of the total number of patients for " the province. In the course of the next few years several of the Burman medical " students who are now being trained in India will have finished their course, and " will be placed in charge of out-station dispensaries. It is reasonable to hope that " the confidence of the Burmese in European medicine and surgery will increase " when they find men of their own race in charge of dispensaries." Most of the institutions are managed by municipal and town committees, and it is satisfactory to learn that they take an intelligent interest in the working of these charities.

Lock Hospitals.

Working of the Contagious Diseases Act.

The results of the experimental closure of selected lock hospitals in India have proved so unsatisfactory that the Government of India have ordered the re-opening of all the institutions which were tentatively closed, and the maintenance of restrictive measures in all their former fulness. The subject is most exhaustively treated in an interesting paper by Surgeon-Major A. Barclay (*see* p. 97), wherein he traces the progress of the Contagious Diseases Act since its introduction in 1864, and adduces

evidence showing the usefulness of its protective measures. "A careful review of the "whole question showed," Dr. Simpson, the Sanitary Commissioner with the Government of India, states, "that much of the increasing venereal prevalence of late years was "due to the greater youth of the army since the introduction of the short-service "system of enlistment, though, doubtless, also much may be due to relaxed efforts in "enforcing the rules of the Cantonment Act for the prevention of venereal disease."

Bengal.

The results of the working of the four cantonment lock hospitals in Bengal during 1885 were, on the whole, less satisfactory than in the previous year. At Dinapore Station, out of an average strength of 920, the admissions into hospital on account of venereal disease were in the proportion of 219·80 per 1,000 against 265·21 in 1884, the decrease being due, it is believed, to the system introduced into this cantonment of segregating the women of a certain quarter for the exclusive resort of European troops. At Barrackpore, the ratio of admissions per 1,000 of an average strength of 206 was 194·17 against 146·2; but, out of a total of 40 cases, only in 20 was the disease contracted at the station. Among the troops stationed at Dum Dum, the admission-rate equalled 345·94 per 1,000 of an average strength of 688, against 264·3 in the previous year, the increase being attributed, to some extent, to the contraction of disease by fresh drafts of troops before their arrival at the station from England and Cawnpore. The results at Darjeeling also compare unfavourably with the previous year, the number of admissions being in the ratio of 186·91 per 1,000 of an average strength of 214, against 170·12 in 1884. At all the stations, excepting Barrackpore, the number of registered women found diseased at the periodical examinations, and detained in the hospitals for treatment, was greater than in 1884.

Madras.

In Madras City, the Contagious Diseases Act continued to work smoothly. During the year, 16,739 inspections were made among 627 registered women, with the result of 550 cases of disease. Among the garrison troops, there was a slight increase in the number of admissions for primary syphilis and gonorrhœa; and in the Madras Lock Hospital 567 cases of venereal disease were treated during 1885–86.

The principal feature in the working of the military lock hospitals of the Madras Presidency during 1885 was the experimental closure of the institutions at Bellary and Cannanore. The results of this experiment proved so unsatisfactory as to convince the Commander-in-Chief "that the maintenance of lock hospitals is very desirable; for, "although they may not prevent disease, they tend very materially to keep the preva-"lence of venereal disease within bounds, and also to mitigate the virulence of the type "of disease." From all forms of venereal disease the admissions among the troops at the seven stations with lock hospitals were 1,560, or 273·30 per 1,000 of an average strength of 5,708, against an admission-rate of 272·12 in 1884. At three stations out of the seven, including Cannanore and Bellary, which were only open for the first quarter of the year, there was a decrease in the admission-rates as compared with 1884, as shown in the following statement:—

Stations.	Admission-rate per 1,000 of Strength.		Stations.	Admission-rate per 1,000 of Strength.	
	1884.	1885.		1884.	1885.
Bangalore - -	290·35	237·20	St. Thomas Mount - -	186·24	181·18
Bellary - - -	329·32	407·76	Secunderabad - -	253·14	254·72
Cannanore - -	248·25	216·08	Wellington - -	330·32	570·29
Kamptee - - -	240·83	259·71			

In his report for 1884 the Surgeon-General endeavoured to show by statistics that lock hospitals in the Presidency had hitherto been kept up for the propagation of venereal disease amongst British soldiers; but the result of the closure for nine months of the year under notice of the Bellary and Cannanore institutions negatives this conclusion. He says: "It was pointed out that the ratio of admissions per 1,000 of "strength during five years from primary syphilis and gonorrhœa at five stations "where no lock hospitals existed was 50·19 and 76·80 respectively, and at stations "where lock hospitals existed 112·70 and 116·68. During the nine months the lock "hospitals were closed at Bellary and Cannanore the total admissions for these diseases "were primary syphilis 374, and gonorrhœa 225, or an annual ratio per 1,000 of "strength of 283·33 for primary syphilis, and 170·45 for gonorrhœa. These figures "prove beyond question that the establishment of lock hospitals at Cannanore and "Bellary is a necessity, and it may also be inferred that these institutions at other

" stations controlled to a considerable degree the spread of the disease. The failure " in the working of the lock hospital system must be attributed solely to the inefficient " manner in which the Contagious Diseases Act is carried out by those who are ' responsible." Further evidence is shown in the comparative prevalence of secondary syphilis at the several stations during 1884–85 and 1885–86. There was a decrease at all the stations where lock hospitals were established, except at St. Thomas' Mount, where the admissions numbered 11 in both years, and at Bellary and Cannanore, where they rose from 22 to 34 and from 4 to 40 respectively.

Bombay. The Contagious Diseases Act worked satisfactorily in Bombay during 1885. Of 12,289 examinations, 3·35 per cent. of the women were found to be diseased, and among the newly registered women the proportion was 5·78 per cent. It is reported that very few sailors contracted venereal disease during the year, and that at the various hospitals a decrease was observed in the number of cases of primary syphilis treated.

The results of the working of the ten lock hospitals which were maintained for the benefit of European soldiers were, on the whole, satisfactory, and compared favourably with the records of the three stations whose hospitals were tentatively closed. " The " closure of the lock hospitals," the Surgeon-General states, " was attended by such a " marked increase in the number of cases, that medical officers were unanimous in " pronouncing in favour of these institutions being re-opened. Whatever may be the " arguments and opinions of the opponents of the Contagious Diseases Act, I think that " there cannot be any doubt as to the efficacy of the measures now adopted in considerably " diminishing the number of soldiers rendered ineffective by venereal disease. Owing " to the fact of a number of cantonments being in native territory, and to the limited " area round each cantonment in which the lock hospital rules can be enforced, the " full benefits of the measure cannot be expected in India."

North-Western Provinces and Oudh. Venereal disease was unusually prevalent among the European troops stationed in the North-Western Provinces and Oudh during 1885. The four first class lock hospitals at Allahabad, Cawnpore, Meerut, and Chakrata were closed as a tentative measure, but a careful record of disease was maintained, and this bears witness to a very great increase of disease. The statistics of the 14 hospitals which were maintained also showed that the year was altogether abnormal in the matter of prevalence of disease. The Sanitary Commissioner states the " figures are such as have " never before fallen to my lot to record in all these series of 12 reports. As " regards the garrison generally, they witness to the unprecedented ratio of 346·3 " admissions to hospital per 1,000 of strength for comparison with 224·9 in 1884. " As regards the garrison of the four stations of abolished management, they " witness to a mean admission ratio of 468·4 for comparison with 218·8 in 1884. " As regards the 14 stations of continued management, they witness to a mean " admission ratio of 349·2, for comparison with 262·7 in 1884." In the opinion of the Local Government, " the results of the year give occasion for considerable concern, " and already indicate a doubt whether the system of cantonment lock hospitals can " be relaxed or abandoned without a serious increase to service incapacity in the " troops."

Punjab. Out of 16 military lock hospitals in the Punjab 6 were closed during 1885 as a tentative measure. As far as the health of the troops is concerned, the closing of these institutions produced most unsatisfactory results, the ratio of admissions from primary syphilis and gonorrhœa being 318·4 per 1,000 of average strength, against 216·1 at the ten stations where lock hospitals were maintained. The effect of the suspension of the lock hospital system is more clearly shown in comparing the statistics for 1885 of the six stations where the lock hospitals were closed with those of the previous year. The ratio of admissions rose from 180·7 per 1,000 to 318·4, and at one station (Kasauli) the ratio was three times greater, viz., 401·4 against 133·0. Of the ten stations where the lock hospitals were retained there was an increase of disease at three—Umballa (from 183·4 to 259·7), Dagshai (187·1 to 208·1), and Nowshera (121·7 to 273·7).

Central Provinces. At the four lock hospitals in the Central Provinces, the average number of prostitutes on the registers during 1885 was 158, or three more than in the previous year, and the number found diseased at the periodical examinations was 264, or 55 less than in 1884. Among the troops at the four stations, there were 745 admissions, equal to 334·18 per 1,000 of an average strength of 2,229. The highest admission rate was

again recorded at Jubbulpore, viz., 433 per 1,000 against 405 in 1884. Kamptee came next with an admission rate of 264·16 per 1,000, as compared with 179·4 in the previous year. At Pachmarhi, the admissions were in the proportion of 149·12 against 235·77 per 1,000, and at Saugor 126·63 against 184·4 in 1884. Medical officers in charge were generally of opinion that the prevalence of disease was chiefly due to the carrying on of clandestine prostitution by unregistered women, to whom the men obtain access. "The remedy," the Chief Commissioner states in his review, "would "appear to lie in the exercise of greater watchfulness over the proceedings of the "men by the military authorities. The very small number of women registered in "Kamptee, Jubbulpore, and Saugor, as compared with the population of the area "under the Act, shows that the registration system has not, as yet, had anything "approaching a fair trial."

Lower Burma.

The provisions of the Contagious Diseases Act were in force during 1885 at the same towns of Lower Burma as in the previous year, viz., Rangoon, Toungoo, Thayetmyo, Bassein, and Akyab. The lock hospitals at the three first were maintained for the protection of troops, and the two latter for the benefit of the seafaring population. The European garrison increased from 1,628 in 1884 to 1,861, and the results among them were very unsatisfactory, the admissions to hospital having increased from 288, or 176·86 per 1,000 of average strength, to 370, or 198·8. The excess was confined to Rangoon and Thayetmyo, especially the former, where the admission-rate rose from 193·29 per 1,000 in 1884 to 286·99, while at Toungoo, where the increase was most marked in the previous year, there was a diminution of over 50 per cent. In concluding his remarks on the returns of the year, the officiating Surgeon-General (Dr. R. Pearse) states: "I will only observe that, whilst admitting, "as everyone must do, that the morality, the efficacy, and the desirability of the "Act are alike denied by many persons, still the Act exists, and is for these places "law, and as such to be obeyed, and it would seem but right, therefore, that some "effort should be made to carry out its provisions more fully, for that it is protective "the Rangoon statistics of the past five years prove beyond possibility of cavil, "whilst due supervision with a staff of one inspector and one constable in this large "town is, on the face of it, an impossibility." The attention of the Rangoon Cantonment Committee has been called by the Chief Commissioner to the unsatisfactory working of the Act. The total number of prostitutes on the register during 1885 was 776, against 620 in 1884, and the cases of disease among them was 891 against 956.

The admissions to dispensaries of the five towns for venereal diseases numbered 2,658, or 64 more than in 1884. The Sanitary Commissioner again noticed that the "general public seem to derive as little protection from registered prostitutes as the "military; but it should be borne in mind in this connection, that dispensaries are "yearly becoming more and more popular."

Lunatic Asylums.

Bengal.

During 1885 there were 1,151 lunatics in confinement in the five asylums of Bengal, against 1,139 in the previous year. Of these, 93 were discharged cured, 26 were made over to the care of friends, 4 were otherwise discharged, and 73 died, leaving 955 under treatment at the end of the year. The percentage of recoveries calculated on the mean daily strength of 940 was 9·89, against 9·77 in 1884, and 11·29 the mean of the previous decade. The health of the asylums was generally good: the number of admissions to hospital were 351, or 14 less than in 1884, and the deaths (73) were also fewer by 14. There were only two cases of cholera, which occurred at Berhampore Asylum, and these recovered. "That the asylums should have been so free from cholera," the Inspector-General reports, "considering its prevalence in their immediate vicinity, is "very satisfactory. The immunity, it may almost be said, which these institutions "enjoyed from this most fatal disease, reflects the greatest credit on the responsible "officers, and speaks volumes as to the admirable sanitary condition of their respective "charges." Another satisfactory feature in the health of the asylums was the decrease in the deaths from phthisis from 26 to 11. There was an absence of injuries of any kind in most of the asylums, which "speaks highly for the great care and humanity "exercised over the poor afflicted inmates."

The number of criminal lunatics under treatment in the asylums during the year was 467, against 445 in 1884; the fresh admissions and re-admissions numbered 104 against 86. By the close of the year the number was reduced to 387 by 50 discharges and transfers and 30 deaths.

The returns of the European asylum at Bhowanipore for 1885, which are not included in the above, showed that there were 51 patients under treatment, 20 being new admissions. Of these, three were discharged cured, three were despatched to Europe under the Merchant Shipping Act, three were sent to Europe as still insane, 12 were made over to the care of friends, and one died. The general health of the patients was very satisfactory, there being little or no sickness throughout the year.

Madras. The report on the working of the three lunatic asylums in the Madras Presidency for 1885 only covers a period of nine months, in consequence of its having, for the first time, been drawn up for the calendar, instead of, as heretofore, for the official year, a change which was much desired, but which prevents any close comparison between the results under notice and those of previous years. The number of patients under treatment during the nine months ending December 1885 was 727, of whom 179 were fresh admissions. Of these, 58 were discharged as cured, 34 were transferred to the custody of friends, 8 were otherwise discharged, and 27 died, leaving 600 in the asylums at the end of the year. Out of 220 cases in which the causes of insanity were assigned, 155 were of a physical and 65 were of a moral nature. The general health of the patients was, on the whole good, while the whole of the institutions were free from epidemic disease. The proportion of deaths to daily average strength was 46·4 per 1,000 against 67·1 in the previous official year. As usual the working of the asylums was satisfactory, and improvements continued to be effected in the occupations and amusements of the patients. Criminal insanes numbered 124, of whom 11 were discharged and 3 died. Additional accommodation for this class of insanes has been sanctioned with the view of relieving those in the jails awaiting admission.

Bombay. At the five lunatics asylums in the Bombay Presidency 899 persons were treated during 1885, against 920 in the previous year. The cause of insanity was known only in 415 cases, and of these 344 were classified under physical causes, chiefly excess in the use of ganja, and 71 under moral causes. Before the close of the year 221 patients were discharged, 63 as cured, and 48 died, as against 59 deaths in 1884. There remained, therefore, 630 lunatics under treatment at the end of the year. The general health of the inmates of the asylums was, with the exception of an outbreak of cholera at Dharwar, which resulted in 4 deaths, very satisfactory. Criminal lunatics under confinement numbered 114, or 2 less than in 1884, and of these, 16 were discharged, 14 as cured, and 7 died. The institutions were inspected during the year by the Surgeon-General, who reported favourably on their management and sanitary condition. Since the close of the year the new asylum at Ratnagiri has been opened and the one at Dharwar enlarged, and it is hoped that the accommodation thus provided will meet the wants of the Presidency.

Punjab. There are two lunatic asylums in the Punjab, viz., Lahore and Delhi, and at these there were 495 patients under confinement during 1885, or two less than in the previous year. Of this number 48 were cured and 15 were transferred to friends. The general health of the lunatics was on the whole good; there was no epidemic disease, but the deaths numbered 42, or one more than in 1884. The mortality at Lahore was greater by 8 deaths, the number having increased from 23 to 31, while at Delhi the deaths decreased from 18 in 1884 to 11 in 1885. The increase at the former asylum was chiefly due to pneumonia, which was very prevalent both in the asylum and throughout the station generally; but the deaths were mostly among old, diseased, and worn-out patients. During the year an addition was made to the Lahore asylum of a European ward and six additional solitary cells; the scheme for providing the asylum with a sufficient supply of pure water from the Lahore waterworks, through the railway main, was also completed. The Delhi Asylum was still in want of a good water-supply, no progress having been made with the scheme.

North-Western Provinces and Oudh. The year 1885–86 opened with 976 patients in the four lunatic asylums in the North-Western Provinces and Oudh, and during the year 363 fresh cases were received, making a total of 1,339. Of these, 272 were discharged, and 89 died. As in the previous year the health of the inmates was best in the Bareilly and Benares Asylums, the death-rates being 42·9 and 67·0 per 1,000 of average strength respectively against 69·0 and 19·0 in 1884. At Agra Asylum the mortality was 133·6, identically the same as in the previous year; and at Lucknow it reached 158·6 against 116·9 in 1884. The accommodation was sufficient on the whole, but the distribution was unequal, and at

Benares the asylum was overcrowded throughout the year. Special measures were being taken to reduce the number of inmates.

There were 348 lunatics under treatment in the two asylums (Nagpur and Jubbulpore) of the Central Provinces during 1885, against 321 in 1884. The fresh cases numbered 62; but of these 47 were admitted to the Nagpur asylum, which, since the closing of the Amraoti Asylum receives all the fresh cases from Berar. Of a total population of 200 in the Nagpur Asylum, 25 were discharged, 12 as cured, and 10 improved, while 10, or 61·8 per 1,000 of daily average strength, died; and the total number treated at the Jubbulpore Asylum was 148, of whom 6 were discharged cured, and 6, or 45·1 per 1,000, died. In both asylums the accommodation was ample; but there was more sickness than usual, and both recorded a higher mortality than in the preceding year. The superintendent of the Nagpur asylum reported that the patients under his charge were a "sickly, weakly lot, in poor health," and that there was nothing special in the conditions either of the season or of the asylum, which stands on a healthy open site, to cause an increase in the sick and death rates; and the superintendent of the Jubbulpore Asylum stated that although there was more sickness than usual, the asylum was very healthy, the illness being generally very trivial. Much useful and profitable work was done during the year by the inmates of Nagpur Asylum in out-door, including agricultural, pursuits, while at Jubbulpore the patients were employed in manufacturing operations. Central Provinces.

There were 78 lunatics under treatment in the Tezpur Asylum in Assam during 1885, or 10 less than in the previous year. The new admissions and re-admissions numbered 23; 11 were discharged, 1 died, and 2 escaped, leaving 64 patients in confinement at the close of the year. The asylum was free from cholera or other epidemic disease; but the average number of sick was nearly double that of 1884, though the diseases were slight. There was only one death against eight in 1884, and this occurred in a patient who had been admitted in very indifferent health. The cultivation of sugar-cane was continued and extended during the year, and the estimated profit of these operations amounted to Rs. 185. Other useful and healthy out-door pursuits were also engaged in by the patients. In the course of the year the asylum was twice visited by the Sanitary Commissioner of the province, who testified to the skill and humanity with which it was administered by the Superintendent, Dr. Campbell. Assam.

The population of the Rangoon Lunatic Asylum during 1885 was 254, or 4 more than in 1884. Of these, 70 were new admissions, and 2 re-admissions, being an increase of 12 on the previous year. Before the close of the year, 40 patients had left the asylum, 15 as completely, and 23 as partially, cured. The health of the patients was unusually good, and the deaths decreased from 23, or 127 per 1,000, of average strength in 1884 to 12, or 63 per 1,000. The administration of the asylum continued to be conducted in an able and efficient manner, and the sanitary arrangements were satisfactory. The occupation of the patients was the same as in previous years. The making of furniture, however, was discontinued, there being no market for it, and a dairy was started, which proved a financial success. Lower Burma.

Medical Schools.

In the medical schools of Bengal the number of students declined from 804 in 1884–85 to 752. On the opening of the session of 1885–86 there were 132 students at the Calcutta Medical College; 26 rejoined, and 60 new students attended, making a total of 218 against 217 in the previous year. Out of 34 candidates for the 1st M.B. and L.M.S. examination, 14, or 38 per cent. passed, against 44 per cent. in the previous year, and out of 41 candidates for the final university examination, 28, or 68 per cent. passed, against 56 per cent. in 1884–85. Three native *dhais* passed in midwifery, and received certificates of qualification, and five pupil nurses qualified for midwives. The hostel for female students of medicine, which has been constructed from the munificent gift of Rs. 1,50,000 made by Her Highness the Maharani Sarnamayi, was completed, and was ready for occupation. It has been decided that girls passing the University Entrance Examination should be admitted, and that after a three-years' course of classes and practical instruction, and on passing the final test and honour examinations, they should receive a certificate, qualifying them to practise medicine, surgery, and midwifery. A grant of Rs. 3,000 was made by the Bengal Government for furnishing the hostel, and Sir Walter de Souza contributed Rs. 2,400 Bengal.

to the Countess of Dufferin's fund for the provision of scholarships. The results of the examinations of the four vernacular schools were, on the whole, satisfactory. The number of students who attended the Campbell Medical School, Sealdah, was 192, against 207 in 1884–85, and of these 51 second-year students appeared for the first license examination, when 45, or 88 per cent., passed, against 92 per cent. in the previous years; and of 53 final students, 46, or 87 per cent., passed the second license examination, against 98 per cent. in 1884–85. From the medical schools at Dacca, Patna, and Cuttack 37, 25, and 8 students respectively passed the final examination qualifying them for employment as civil hospital assistants, against 31, 16, and 11 in the previous year. There was a falling off in the attendance at the Patna Medical School from 151 in 1884–85 to 92, which was attributed to the backwardness of middle education in Behar, and the consequent difficulty of keeping up a supply of students who have passed the middle-scholarship examination. The question of revising the standard of admission to the school was under consideration. At the two homœopathic medical schools at Dacca there were 157 pupils, or 11 less than in the previous year.

Madras.

At the opening of the session of 1885–86 there were 226 students in the Madras Medical College, against 215 in the previous year; but at the close of the session the number was reduced to 214 through death and other causes. With the exception of 9 female students, and those in the chemist and druggist class, all the students had passed some university examination, a fact which, as the Acting Director of Public Instruction stated, augurs well for the future of the institution. For the several university examinations, 116 candidates presented themselves, when 71, or 61·2 per cent., passed. From the Senior Department, out of 84 students who went up for the first L.M.S. examination, 24 failed in anatomy; consequently steps were taken of giving extra time and attention to that subject. In the second department there were 71 male and 5 female students, and the results of the primary and final examinations were reported as highly satisfactory. The number of students was steadily diminishing in this department, and in another two years it will cease to exist, the Government having ruled that the system of gratuitous education, which has been in force in it since the opening of the institution in 1835, be given up.

Altogether there were 14 female students in the college, all of whom made good progress in their studies, while some of them were seeking university distinctions. "Female medical education," the Director reports, "may now be considered well "established in Madras, and there is not the slightest reason to doubt that with time "the institution will be able to contribute largely to the supply of well-qualified "medical women to the country. The growing desire among women for a sound "medical education, is not to be wondered at, the history of those who passed out in "former years, as given in the report, being a narrative of remarkable success in "life."

Bombay.

The excellent standard at the Grant Medical College was fully maintained in 1885–86. The number of students on the rolls was 296, of whom 18 were women. Out of 50 senior students who went up for their degree, 28 passed. For the first and second examinations under the old system 47 passed out of 107 candidates, only 23 passing the first examination. For the second examination under the new system there were 12 candidates, of whom 11 passed; while for the first examination, 27 out of 50 candidates passed. Fourteen military pupils qualified for the grade of Sub-Assistant Apothecary. Dr. Cook, the principal of the college, gives a favourable account of the new class for women. He says there were 17 women in the class at the commencement of the session, but that two left. Of the remaining 15, two were undergraduates of the Bombay University, and were attending the third and second year's classes respectively. Their success in the terminal examinations was satisfactory, one holding the third rank in a class of 48 matriculated students, and gaining a scholarship, and the other being seventh in a class of 50 students. There were three fresh admissions in the course of the session, of whom two were matriculated students, bringing the total number attending the class to 18.

At the Government Medical Schools at Poona, Ahmedabad, and Hyderabad the average attendance of pupils was 155, against 164 in 1884-85. At Poona 11 students of the third-year class passed the final examination, 8 being native medical pupils of the Civil Department. At Ahmedabad 16 senior students passed for promotion, and at Hyderabad 12 senior students passed out of the school, 6 of whom were sent to military duty, 5 were taken into Government employ in the Civil Department, while the twelfth man intended to practise in Sind.

North-Western Provinces and Oudh.

The number of students attending the Agra Medical School during 1885–86 was 120, or 10 more than in the preceding year. The first class, composed of 29 pupils, was one of more than average merit, and all the students in the civil and military sections succeeded in passing the examinations. The second class also consisted of 29 pupils, who did not figure well in the examinations, and both the military and the civil divisions were inferior. On the other hand the female section of this class did much better than the female section of the first class, three of the five pupils having distinguished themselves in their examinations. The 15 students, who after passing through the first year's course, were sent for a year's training to a dispensary, with three exceptions did well. The fourth, or junior class, which consisted of 47 pupils, of whom 18 were females, was reported as a particularly promising one. The field of selection of this class was very large, as no less than 98 candidates, of whom 10 had passed either the entrance examination or the middle class Anglo-Vernacular examination, presented themselves for admission to the civil section of it. Much interest was shown during the year in female medical education. "Cordial support has been "accorded by municipalities and private persons, and by the National Association for "supplying female medical aid to the women of India, and there is every reason to "expect that a sufficient supply of candidates will be maintained. The defective "general education of the majority of native girls in the classes from which the "candidates are drawn, which is now the main obstacle to the complete success of "the enterprise, is in a fair way of being remedied by the growing demand for "instruction, and the appointment of a lady teacher will add greatly to the "popularity of the lectures."

Punjab.

The average number of students on the rolls of the Lahore Medical School during 1885–86 was 192. The results of the final examinations showed that in the English class 11 students out of 18 passed for the diploma of Licentiate in Medicine of the Punjab University; 6 students also passed from the English class as civil hospital assistants. In the Hindustani class 19 students passed their final examination, and most of them became hospital assistants, making a total of 36 who passed their final examination during the year. An important measure was carried into effect during the year in the appointment of a lady, Miss E. Bilby, to teach midwifery to the female students. Two additional professors have also been added to the staff of the school, to be paid partly by contributions from municipal funds and partly from the provincial revenues, and it was anticipated that before the close of the next session the students of the institution, which has now a very strong staff, would be able to take degrees in medicine.

VII.—SANITATION.

Civil.

Bengal.

SATISFACTORY progress was made in improving the sanitary condition of the town of Calcutta during 1885. Much attention was given to the reclamation and improvement of bustees. In thirteen of them the improvements were completed; in two they had been commenced; projects for the improvement of four were approved; while projects for improving nineteen more were under consideration. "Though much remains to "be done, the more urgent cases," it is reported, "have now been disposed of, and "the chief duty of the Commissioners will consist in maintaining the ground they "have gained." Progress was also made in tank filling. Forty-one bathing platforms were completed, and were in actual working order; six others were completed, but required to be connected with the piping to make them fit for use. These bathing places are very popular, as is shown from a census taken on the 11th and 18th April 1886, when the total number of bathers amounted to 62,000 daily. Works were in course of construction for increasing the supply of filtered water to the city, and steps were being taken to extend it to the suburbs. The supply of unfiltered water was increased from 1,491,441 gallons per diem in 1884–85 to 1,670,024 gallons in 1885–86.

The drainage works of the town were virtually completed during the year, the only portions remaining unfinished being a small area in Baug Bazaar and Hastings Ward. Of the total 33,969 premises in the town, 22,482 were up to the end of the year connected with sewers. The conservancy arrangements were satisfactory. As regards the present state of sanitary work in municipal Calcutta, the Army Sanitary Commission make the following remarks: "The extent and importance of this work "cannot be denied, and as we have pointed out in our preceding Memorandum "(for 1884) the results are clearly shown in the reduced general death-rates. The "prevalence of epidemics, especially of cholera, and the localized character of the "death-rates clearly point to insanitary conditions in special localities as presenting "the problems now to be grappled with."

Of the income of the Bengal municipalities in 1885, amounting to Rs. 30,41,223, a little more than half (57 per cent.) was spent on sanitary work including roads. It was, however, very unequally distributed, and in some of the more important towns the proportion was so low, not even 10 per cent., that the attention of the authorities concerned was drawn to the matter. Among the works executed or undertaken during the year the following may be mentioned:—In Burdwan a further sum of Rs. 39,985 was expended in completing the waterworks. The filtered water-supply of this town, it is reported, continues to confer immense benefit to the people, and to have diminished sickness and mortality; for improving the water-supply of certain distressed tracts of Burdwan district a sum of Rs. 35,000 has been advanced. Arrangements were being made for supplying good drinking water to portions of the city of Moorshedabad remote from the river, and also for improving the supply at several of the stations on the Eastern Bengal State Railway. The waterworks project in the town of Bhagulpore was commenced. A water-supply scheme for Cuttack was devised; and an experimental water-supply scheme for Puri was in hand. Much was done for improving the drainage of Midnapore town, and in the district the Supai drainage scheme was continued at a cost of Rs. 73,800. In many other towns and districts important drainage works were being actively carried out. In the course of the year the Sanitary Commissioner inspected a number of municipalities; in some cases he found that much activity was displayed in sanitary matters, while others, notably the suburbs of Calcutta, were "in the worst possible condition." Good work appears to have been done in the inspection of vessels at the Port of Calcutta by the health officer, who complained of the pollution of the Hooghly by the discharge of night-soil into it within the limits of the Calcutta South Suburban Municipality. The Government of India hoped that measures would be taken to put a stop to so serious an evil.

Madras.

In continuing the Black Town drainage scheme a sum of Rs. 1,46,807 was spent during the year, making the total expenditure up to date Rs. 5,75,939, out of a total estimate of Rs. 8,07,500. A scheme was submitted for the improvement of the water-supply, but had not been discussed by the Commissioners. The works of that portion

of the scheme already sanctioned, consisting of off-take tower, machinery, valves, and culvert, with a double line of 24-inch diameter pipes through it, were completed. The injury sustained to the Red Hills Reservoir by a cyclone in the previous year was under restoration until November, and from May to that date the whole of the supply to the city had to be pumped from the lake to raise the water high enough to allow it to flow down the delivery channel.

Out of a total municipal income, excluding Madras town, of Rs. 18,79,480 for the year 1885-86, the allotments for sanitary purposes amounted to Rs. 5,91,071, of which Rs. 4,21,768 were expended during the nine months ending December 1885. No new sanitary work of any great magnitude was executed during the year, but various improvements in regard to water-supply and conservancy were carried out by municipal councils, the most important being the improvement of the water-supply of the town of Cuddalore. In the Local Fund Circles, which are distinct from Municipalities, Rs. 3,41,504 (or one-third of the land cess) were sanctioned for sanitary improvements, but up to the end of December only Rs. 1,95,660 had been expended. The Government again called the attention of the several authorities to the subject, and requested that the whole of these annual grants might be utilised for the purposes for which they were intended. In April 1885 a new Act, called the Madras Local Boards Act of 1884, superseding Act IV. of 1871, was introduced. Under this Act each district has been constituted a board, whose duty it is to provide, in regard to sanitation, "for the improvement of village sites and water-supply, for sanitary "arrangements during fairs and festivals, for the scavengering of small towns and "large villages, for the construction and repair of markets, slaughter-houses, latrines, "dust-bins, and drains, and other measures calculated to promote the health, comfort, "or convenience of the people."

Early in 1887 the Sanitary Commissioner submitted to Government certain proposals for improving the sanitary condition of towns and villages. These have been communicated to all presidents of district boards with instructions to state in their annual reports how far they have been able to carry out the suggestions.

Much activity was shown in Bombay Municipality during the year in the execution of sanitary work. The Tansa water-supply scheme for obtaining a supply of 17 million gallons a day, at an estimated cost of Rs. 1,23,00,000, was adopted and the works commenced. The existing water-supply from the Tulsi and Vehar lakes was much improved and extended; and the Bhandarwada waterworks were completed as well as the reservoir and filter works on Malabar Hill. Several important drainage works were carried out, including the storm-water drainage works in the city, by the completion of which "places which formerly were knee-deep in water after a com- "paratively moderate fall of rain now become dry in a very short time." In addition, the conservancy of the city was well attended to, and good work was done in providing gardens and spaces for recreation. Bombay.

Although no sanitary work of any great importance was executed in Bombay Presidency during 1885, a great many improvements were effected in drainage, water-supply, latrines, markets, and other minor works. The total income of the municipalities amounted to Rs. 30,70,624, of which Rs. 6,83,668 were spent on conservancy. In some of the Local Fund Circles, which include the country population, considerable sums were expended on sanitary works, consisting chiefly of improvements in water-supply by the construction and repairing of wells. In their Orders on the Sanitary Commissioner's Report the Government of India notice the indifference displayed by some of the cities in sanitation, especially those of Broach, Surat, and Ahmedabad, in the latter of which the average mortality exceeded 53 per 1,000, and they directed that the urgent necessity for improvement should be strongly impressed upon the authorities. In the case of Ahmedabad, the city was inspected by Colonel Ducat, the newly appointed Consulting Sanitary Engineer, who submitted a report on its water-supply and sewerage, which was under the consideration of the Municipal Commissioners. The subject of village sanitation was engaging the attention of the Bombay Government, who have issued a resolution setting forth the principles on which a draft Bill was to be prepared to give effect to more efficient measures of village sanitation. Various sanitary improvements were being carried out in the Port of Bombay, which it is hoped will be effectual in stamping out its local disease causes. While admitting the important advances which are being made in matters affecting the health and commerce of the Port of Bombay, "we are bound to state," the Army Sanitary Commission remark, "that, so far as regards the civil population "of the Presidency, the statistics show clearly enough that past methods of dealing"

" with local causes have been without material influence on the public health. This " statement includes not only the health of the village populations, but also the health " of towns having local executive bodies."

Punjab.

The work of sanitary improvement received much attention in the Punjab during 1885. Several important works were executed, and others taken in hand. Among those completed were the drainage works of the Dera Ghazi Khan cantonments, the outfall channel at Amritsar, where also good progress was made in filling up the ditch round the city, which, when completed, is expected to exercise a marked and beneficial influence on the health of the city; further, a large low-lying dense garden, which was a source of danger to the health of the thickly populated part of this city, has been converted into suitable building sites. "The large sanitary works " carried out, or being carried out, in connexion with the city of Amritsar," the Lieutenant-Governor observes, "are creditable to the municipality and indicative of " an enlightenment and energy which other municipalities would do well to emulate." Considerable progress was made with the Simla sewerage works. A scheme for the drainage of the city of Gujranwala was approved by the Government, and certain works in connexion with the drainage of the Lahore Female Penitentiary were executed by jail labour. Projects for the supply of water to the city of Peshawar and to the cantonment of Edwardesabad were under preparation, and the Rawalpindi water-supply scheme was approved. Altogether a sum of Rs. 9,16,669 was allotted by the municipalities for sanitary purposes, the chief item being conservancy. The sale of town manure realised Rs. 84,621. The Government of India, in their Orders on the Sanitary Commissioner's Report, notice the efficiency of this system of disposing of sewage, stating that it appeared to be well worthy of adoption in other provinces, and that the attention of local governments would be invited to the matter.

North-Western Provinces and Oudh.

No sanitary works of any great magnitude were executed in the North-Western Provinces and Oudh during 1885, but good work was done in the municipalities in improving drainage and water-supply, in the sinking and repairing of wells, and in providing latrines, &c. Among the most important works were the improvement of the water-supply of Mussoorie, and the construction of a permanent main drain to the south of the city of Meerut. Sanction was given to the municipality of Dehra Dun to raise a loan of Rs. 12,000 for improving its water-supply, and Saharanpur borrowed Rs. 25,000 for completing the drainage system of the city. The Sanitary Commissioner testifies to the interest and anxiety shown by local boards in sanitary improvements. To mention all that has been done, he says, would occupy too much space. "But this I can say, that wherever—be it in town or village—any very necessary " improvement is manifestly necessary in the interests of the public health, the local " authorities as a rule evince great anxiety to effect the improvement in practical " fashion. And that, sooner or later, as the means become available, the necessary " work will be done." In the improvement of village sanitation, progress is slow. "The subject," the Lieutenant-Governor states, "is a difficult one; the local officers " have to rely entirely on their personal influence, and pressure may often do more " harm than good. It is clear, however, that some progress is being made; officers " on tour do what they can to promote sanitation, and some change may in time be " effected, by example and experience, in the habits of the people."

Central Provinces.

In the Central Provinces the work of sanitary improvement consisted chiefly in the extension of water-supply, drainage, and conservancy. All the municipalities devoted some portion of their income to sanitary arrangements, though the proportion varied greatly, from 15·63 per cent. in Bilaspur to 61·12 in Damoh. The number of new wells constructed throughout the province in the course of the year was 230. Little was done in improving village sanitation. The subject, however, was receiving attention. At the close of the year some simple rules for the effective sanitation of villages were issued, and experimentally introduced in selected areas, and the Divisional Commissioners have been called upon to report on their working.

Berar.

The most important sanitary works completed in Berar during 1885 were those for supplying the towns of Amraoti and Khamgaon with pure water. The total expenditure on sanitary improvements incurred by the municipalities was Rs. 62,904, or 36 per cent. of their income, the principal item being conservancy, on which alone 21·8 per cent. of income was spent. The amount expended on sanitation by the

District Local Fund Boards was Rs. 90,711, of which sum Rs. 41,770 were expended on villages. In the course of the year the Sanitary Commissioner inspected a number of villages, when he found that the Village Sanitary Code, which was introduced in the province in 1880, required to be more stringently enforced. "The rules," he says, "are not difficult to carry out. Simple cleanliness is what is required (especially "inside the compound or house enclosure), and until this is enforced, it is not possible "to prevent epidemics. Surely, in the interests of the people, Government should "insist on cleanliness in villages, and make penal any breach of sanitary rules." The attention of all district officers has been drawn to this important matter.

Assam. The only sanitary work of any magnitude undertaken in Assam was the water-supply scheme at Gauhati, which was nearly completed at the close of 1885. Considerable attention was given to improving the sanitary condition of Dibrugarh. It is satisfactory also to learn that in the large district of Sylhet interest has been awakened in the subject of sanitation. "During my inspection of the district and personal "communication with local authorities," the Sanitary Commissioner states, "it seemed "clear that most of them were well acquainted with the sanitary requirements of "their charge, but were for the present overborne by prejudices of the people, and "inadequate means to reform the daily habits of such a teeming population." The amount expended by the towns, unions, stations, and municipalities during 1885 on sanitation, including medical relief, was Rs. 89,425, against Rs. 69,177 in the previous year. As regards the sanitary state of the tea gardens, the Sanitary Commissioner says: "I have had further opportunity of seeing the conditions under which the "immigrants are placed; and there can be no reasonable doubt but that these are "very variable. In many gardens the management is concerned to provide all sanitary "improvements regardless of cost, under fully-qualified medical advice; in many "others the tendency is not to interfere with the prejudices of the natives, and to "take things as they come. But on the whole there is substantial progress, and the "more light that is thrown on the subject, the better prospect for the health of the "labourer and the welfare of the property."

Lower Burma. There is nothing very important to record under sanitary works in Lower Burma beyond the completion of the Prome water-supply. The Rangoon drainage scheme alluded to in vol. xviii., p. 41, was approved of by a committee of experts, and proposals for raising a loan to carry out the work has been submitted to the Government of India. A commencement was also made in reclaiming some low-lying land to the east of the town. A fruitful source of disease in the province is cesspits. At the request of the Chief Commissioner, the Sanitary Commissioner when on tour examined a number of them, and called attention to their objectionable and dangerous condition. He urged that "in the case of all towns pressure be brought to bear for "the gradual abolition of cesspits, which are very generally nothing more or less "than unsightly, bad-smelling dung-heaps, and the introduction of latrines." The Chief Commissioner noticed that, except in a few large towns, insufficiency of funds renders it impossible to completely abolish them; but he directed district officers to endeavour by the exercise of personal influence to persuade the people to use the precautions suggested by the Sanitary Commissioner. The amount expended by the Public Works Department during the year on sanitation was Rs. 66,866, of which more than a half (Rs. 34,005) was devoted to markets and Rs. 22,326 to water-supply.

Military.

Bengal. During 1885–86 the total expenditure on military works in the Bengal Command was Rs. 57,39,620, of which Rs. 22,45,367 were expended on original works. At several stations buildings for the accommodation of troops were constructed, and progress was made in road-making. Two important roads were in course of construction, viz., the high-level Bolan Pass Road and the road to connect Cherat *viâ* Chapri with Pubbi, the nearest station on the Peshawar Railway. Little, however, was done under the head of cantonment works, as the Government had given orders to suspend all optional expenditure.

Madras. In the Madras Command various improvements were carried out in barrack accommodation. The new hospital at Rangoon was opened during the year, and the three buildings comprising the hospital for the men were taken over and occupied in June,

while the fourth building forming the women's hospital was taken over in December. Steps were also being taken to improve the sanitary condition of the stations of Bangalore, Secunderabad, and Kamptee, where for some time fatal fevers had been very prevalent.

Bombay.

The actual expenditure on military sanitary works in the Bombay Command during 1885 was Rs. 1,63,233. More than a third of this sum was spent at Bombay and Colaba in minor improvements. A sum of Rs. 64,477 was also expended at Ahmedabad, of which Rs. 63,773 were for a hospital for British troops. This building was commenced in 1881, and was completed, with the exception of some subsidiary buildings, and occupied during the year under notice. At several other stations small sums were devoted to improving men's quarters, water-supply, latrines, &c. The sanitary condition of Quetta formed the subject of much inquiry. The station was inspected at the end of October by the Commander-in-Chief, Sir Donald Stewart, and again in April 1886 by his successor, Sir F. Roberts. It is reported that certain important decisions have been come to or are impending. The district has been removed entirely from Bombay control, and placed under the Government of India, and sanction has been given to the permanent adoption of the Gwashki (*alias* Ziarat) sites for summer sanitaria for British soldiers.

W. T. Ronson.

India Office,
September, 1887.

ABSTRACT

OF

SANITARY AND OTHER REPORTS

FOR

1885.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA.

(*Dr. B. Simpson.*)

European Troops.*

The health of the European troops during 1885 was less favourable than in the previous year.

Abstract of Statistics of European Troops in India for the last eight years 1878 *to* 1885, *and for the ten-year period* 1870–79.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79 - - - -	577,416	1,475	60	19·34	43	62
1878 - - - -	56,475	1,651	68	21·46	45	66
1879* - - - -	49,582	1,977	78	24·28	49†	73†
1880* - - - -	51,796	1,789	74	24·85	26†	51†
1881† - - - -	58,728	1,605	70	16·86	38‡	55
1882 - - - -	57,269	1,445	65	12·07	33‡	45
1883 - - - -	55,525	1,336	63	10·88	33	44
1884 - - - -	54,996	1,513	67	12·56	32	44
1885§ - - - -	56,967	1,533	71	14·55	23	37

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.
‡ Calculated on the strength obtained from Annual Returns. § Excluding troops on active service in Burma.

The admission, daily sick, and death-rates were all higher than in any year since 1881, the first two rates being also higher than the average of 1870–79. The death-rate was about 5 per 1,000 less than the average of 1870–79; although 2 per 1,000 higher than that of 1884. All three Presidencies contributed to this rise in the death-rate, but especially the Bombay Presidency. The loss to the army by invaliding was, on the other hand, much less than usual, as may be seen from the above table. Fevers and wounds were the only diseases that caused higher rates of invaliding than in the previous year; and in 1885 marked reductions occurred in the rates of invaliding from debility and anæmia, hepatitis, respiratory diseases, heart diseases, rheumatic affections and phthisis. The total loss to the army from death and invaliding was 37 per 1,000,—a ratio lower than that of any other year in the above table.

The admission rate in the Bengal Presidency was practically the same as in the previous year: it was reduced by 1 per 1,000. On the other hand, the daily sick and death-rates were substantially higher. It would appear therefore that in 1885 disease, though not more prevalent, was more serious than in 1884. The death-rate from cholera was less than in 1884, while heart disease caused more than three times as much mortality as in 1884; and the rates of death from enteric and other fevers, from dysentery, and from hepatitis were decidedly higher than in 1884. The loss by invaliding was 12 per 1,000 less than in the previous year, and 21 per 1,000 less than the average of 1870–79. The total loss from death and invaliding was 11 per 1,000 less than in 1884, and 29 per 1,000 less than the average of 1870–79.

The health of the British troops in the Madras Presidency, though less favourable than in the previous year, was more favourable than that of the British troops in the other Presidencies in 1885. The admission and daily sick-rates were higher than they were for some years past, the chief heads of the increased sickness being respiratory diseases, phthisis, and venereal diseases. The total mortality, though very low (9·13 per 1,000), was higher than in the previous year (8·53), and that notwithstanding a

* Excluding troops on active service in Burma, returns for which have not been received in full.

diminution in cholera mortality. The chief diseases giving rise to increased mortality were (in order) heart-disease, respiratory diseases, phthisis, and fevers. The loss to the Madras Army by invaliding was low (24 per 1,000) being 8 per 1,000 less than in 1884, and 25 per 1,000 less than the average of 1870–79. The total loss from death and invaliding was 33 per 1,000, which is 7 per 1,000 less than in 1884, and 34 per 1,000 less than the average of 1870–79.

As in the previous year, the European troops in the Bombay Presidency suffered more sickness than those in Madras, and less than those in Bengal; but a much higher mortality than that in either of the other presidencies. The admission and daily sick-rates (1,489 and 68 per 1,000 respectively) exceeded those of any year since 1881, and the daily sick-rate was also above that of the period 1870–79. The heads under which the increased sickness took place were cholera, ague, dysentery, scurvy, and alcoholism. The cholera mortality was very high (6·92 per 1,000). The total mortality (23·82) was higher than that of any year since 1878, except 1880, and much higher than the average of 1870–79 (15·27). The increase of mortality was chiefly under the heads of alcoholism, dysentery, cholera, respiratory diseases, phthisis, and enteric fever. But the mortality in the case of cholera, dysentery, and respiratory diseases, occurred for the most part among the troops in Southern Afghanistan. The loss to the Bombay Army by invaliding (29 per 1,000) was 2 per 1,000 less than in the previous year, and 14 per 1,000 less than the average of 1870–79. The total loss from death and invaliding, 53 per 1,000, was 2 per 1,000 greater than in 1884, but 5 per 1,000 less than the average of 1870–79.

The following table shows that the health of the troops in Southern Afghanistan was even worse than it had been in 1884, especially with regard to cholera; and when compared with the above figures, shows how unfavourably the statistics of the Bombay Presidency are affected by the inclusion in them of the statistics of Southern Afghanistan:—

—	Average Strength.	Ratio per 1,000.						
		Admissions.	Daily Sick.	Deaths from			Invaliding.	Total loss.
				Cholera.	Other Causes.	Total.		
1884	1,441	2,056	83	27·07	41·63	68·70	23·59	92
1885	1,672	2,487	94	42·46	40·67	83·13	28·59	112

The increase of disease as compared with the previous year was under the heads of cholera, ague, phthisis, and rheumatic affections; and the increase of mortality under the heads of cholera, bowel-diseases, hepatitis, respiratory diseases, and anæmia. There was an increase of admissions from fever of 330 per 1,000; but this was due to a rise in the prevalence of intermittent fever; enteric, remittent, and continued fevers being much less common than in 1884. Enteric fever was both less frequent and less fatal in 1885 than in 1884. In the former year 8·4 per 1,000 were admitted, 2·39 per 1,000 died, and 28·57 per cent. of those treated died whilst in 1884 these ratios were respectively 24·3, 7·63, and 31·43. More than half the mortality was caused by cholera. Next to cholera, dysentery, and respiratory diseases were the most prominent causes of death.

The chief causes of admission into hospital in the three Presidencies (per 1,000 of strength) are shown in the following table:—

Bengal.		Madras.		Bombay.	
1. Malarial fevers	611	1. Venereal diseases	350	1. Malarial fevers	578
2. Venereal diseases	303	2. Malarial fevers	149	2. Venereal diseases	272
3. Wounds and accidents	132	3. Wounds and accidents	132	3. Wounds and accidents	122
4. Abscess and ulcer	87	4. Abscess and ulcer	88	4. Abscess and ulcer	69
5. Respiratory diseases	68	5. Dysentery	54	5. Respiratory diseases	67
6. Diarrhœa	56	6. Respiratory diseases	51	6. Diarrhœa	49
7. Rheumatism and rheumatic affections.	48	7. Rheumatism and rheumatic affections.	43	7. Rheumatism and rheumatic affections.	40
8. Dysentery	25	8. Diarrhœa	41	8. Dysentery	29
9. Hepatitis	21	9. Hepatitis	34	9. Hepatitis	18
TOTAL OF THE NINE	1,411		942		1,244
TOTAL FROM ALL CAUSES	1,661		1,154		1,489

Malarial fevers, it will be seen, caused a large proportion of the sickness in all three Presidencies. In Bengal and Madras the ratios for 1885 were less, and in Bombay greater, than those of 1884. In Bengal the admission-rate from malarial fevers was reduced from 683 to 611, but both these ratios are higher than the decennial average of 1870–79, which is 607, though lower than that of 1860–69, which was 633. The decennial average of 1870–79 for Madras was 266, while the admission-rates for 1884 and 1885 were 166 and 149 respectively. In Bombay, on the other hand, though the admission-rate was increased from 504 to 578, the decennial average of 660 was not nearly reached. As usual, venereal diseases head the list in Madras; and both in Bengal and in Madras there was a great increase as compared with the previous year, while in Bombay there was a decrease. With regard to venereal diseases all three Presidencies were above the decennial average of 1870–79, Bengal by 154, Madras by 152, and Bombay by 81. Respiratory diseases were most prevalent in the Bombay Army, and in it only was the decennial average (64) exceeded. We have already seen that a large proportion of these diseases occurred among the troops in Southern Afghanistan, whose statistics are incorporated in those of Bombay. Rheumatic affections were somewhat more prevalent in Bengal than in Madras, and in Madras than in Bombay. As usual, dysentery and hepatitis were much more frequent in Madras than in either Bengal or Bombay.

The chief causes of mortality in the three Presidencies are stated and contrasted in the following tables:—

Deaths from the Chief Diseases and from all Causes in the three Presidencies per 1,000 *of Strength.*

Deaths from	Bengal.							Madras.							Bombay.						
	1885.‡	1884.	1883.	1882.	1881.*	1880.*	1870–79.	1885.‡	1884.	1883.	1882.	1881.	1880.	1870–79.	1885.	1884.	1883.	1882.	1881.*	1880.	1870–79.
Enteric fever	4·05	3·31	2·52	2·90	2·62	3·07	2·28	2·19	1·67	2·86	2·09	0·58	1·36	1·42	2·54	2·05	1·55	1·90	2·83	5·76	1·75
Apoplexy	0·91	1·04	1·32	0·94	1·75	3·14	1·53	0·38	0·84	0·38	0·82	0·96	0·78	1·42	1·14	1·49	1·10	0·63	1·21	3·03	1·56
Hepatitis	0·88	0·84	1·06	1·48	1·64	1·36	2·04	1·04	2·04	1·72	1·72	1·54	1·26	3·16	0·70	1·03	0·82	0·81	1·52	1·31	1·71
Cholera	1·17	1·34	0·94	1·28	3·23	4·84	4·18	0·19	0·93	0·95	0·82	1·73	0·10	1·68	6·92	4·85	0·82	0·63	0·30	—	1·53
Remittent and continued fevers.	0·57	0·36	0·41	0·74	0·70	2·34	1·74†	0·19	—	0·28	0·27	0·19	0·29	0·62†	1·49	2·05	0·55	0·54	0·91	2·73	1·14†
Dysentery	0·34	0·18	0·35	0·77	1·00	2·72	1·37	0·38	0·37	0·28	0·36	1·15	0·58	2·32	2·89	1·03	0·55	0·18	1·82	4·14	0·98
Total of these diseases	7·92	7·07	6·60	8·11	10·94	17·47	13·14	4·37	5·85	6·47	6·08	6·15	4·37	10·62	15·68	12·50	5·39	4·69	8·59	16·97	8·67
All causes	13·16	11·68	11·21	13·17	17·05	27·73	21·00	9·13	8·53	10·19	10·25	10·97	10·18	17·69	23·82	19·39	10·50	10·37	13·44	30·90	15·27

* Excluding troops in Afghanistan and on the march.
† Including deaths from intermittent fever.
‡ Excluding troops on active service in Burma.

Although enteric fever heads the list only in the Bengal Presidency, it does not go down lower than the second place in the other Presidencies, and in all three the ratio is higher than in the preceding year, and than the decennial average for 1870–79. With regard to the high cholera mortality in the Bombay Army, we have already seen that this was mainly due to its unusual prevalence among the troops in Southern Afghanistan. Except in Bombay, cholera was less fatal than it was during the previous year, and than the decennial average. Hepatitis was, as usual, most fatal in the Madras Army, but the ratio was below the decennial average. In Bengal the ratio was very slightly higher than in the previous year; in Bombay it was lower; and in both it was under the decennial average. The Bengal ratio was slightly higher than that of Bombay,—an effect of decrease on the part of Bombay more than of increase on the part of Bengal. In Madras the ratio from remittent and continued fevers rose from zero to 0·19; that of Bengal rose also, while that of Bombay fell. As in 1884, the Bombay Army again showed higher death-rates than the decennial averages for enteric fever, cholera, remittent and continued fevers, and dysentery. In the cases of enteric fever, cholera, and dysentery, the excess over the decennial averages was greater even than in 1884.

The geographical groups into which the Bengal Army has been divided (excluding convalescent depôts in which small bodies of troops are located for a few months of the year only) are enumerated in the following table, together with their admission and death-rates for a series of years:—

Statement showing the Admission and Death Rates in the several Groups of Stations of the Bengal Presidency during the ten-year periods 1860–69, 1870–79, *and during* 1880, 1881, 1882, 1883, 1884, *and* 1885.

Period.	Ratio per 1,000 of strength.													
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilkand.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860–69 -	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	14·78	1,755	29·98
1870–79*	1,311	14·43	1,410	20·06	1,461	18·31	1,330	18·41	1,847	20·71	1,044	12·23	1,522†	21·00†
1880* -	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,253	20·75	1,813	27·73
1881* -	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05
1882 -	1,187	11·19	1,699	22·61	1,613	8·86	1,891	10·51	1,796	12·12	975	8·65	1,579	13·17
1883 -	1,011	9·10	1,474	17·04	1,528	10·56	1,497	14·27	1,601	9·47	1,454	6·33	1,463	11·21
1884 -	1,195	10·07	1,381	14·72	2,028	17·01	1,874	15·53	1,992	9·75	1,201	5·91	1,662	11·68
1885 -	1,449	13·09	1,539	15·23	2,463	18·00	1,687	10·93	1,566	12·67	1,395	9·50	1,661	13·16

* Excluding troops in Afghanistan and on the march. † Including troops in Afghanistan and on the march.

The third group (Meerut and Rohilkund), was the only one which exceeded the Presidency-ratios both in admissions and in deaths. Comparing the ratios of the six groups with the approximate averages of the 20 years 1860–79, we find that sickness was more prevalent than usual in the second, third, and fifth groups, and especially in the third or Meerut and Rohilkund group; while all the groups, except the fourth and fifth, showed a higher rate of sickness than in the previous year. The increase of sickness in the Rohilkund and Meerut group, as compared with the sickness of 1884, was mainly under the heads of fevers, bowel-diseases, scurvy, venereal, and rheumatic affections. Malarial fevers and venereal diseases in all groups contributed most largely to the total admission-rate. The fever ratios varied from 1,322·5 in the third group and 601·3 in the fourth to 361·8 in the sixth. The venereal ratios varied from 422·9 in the third group to 322·2 in the fourth.

It thus appears that while the troops in Hill Stations suffered little during 1885 from malarial fever and dysentery they recorded high ratios for enteric fever and respiratory diseases. In 1884 the Hill Stations suffered little from enteric fever, which was fifth on the list.

Though the death-ratios of all the groups were considerably below the approximate averages of the 20 years 1860–79, yet the Agra and Central India group is the only one whose ratio did not exceed that of the previous year. Since the year 1879 the approximate average of 20 years has never been exceeded in the first and fourth groups, and has been exceeded only once in the second, third, and sixth groups, and twice in the fifth. The mortality of the Hill Stations group is that which has risen most as compared with the previous year, the increase being due to enteric fever.

In Bengal Proper no deaths were recorded from enteric fever, and the greatest mortality resulted from cholera and fevers other than enteric. In all the other groups the highest proportion of mortality was due to enteric fever; and except in the case of the fourth group, the proportion was higher than in the previous year. This increase was most marked in the case of the Hill Stations. All the groups, except Bengal Proper, recorded higher rates of mortality from enteric fever than the decennial average of 1870–79, the second group by 3·61, the third by 3·39, the fourth by 1·29, the fifth by 0·51, and the sixth by 3·98.

Confining attention to those only of the stations in which the average strength exceeded 200, and which were occupied throughout the year, the highest admission-rates were recorded at Delhi (4,185 per 1,000) and at Muttra (3,024). At 10 other stations admission-rates exceeded 2,000. In no station was the admission-rate under 1,000. The smallest ratios were recorded at Rangoon (1,004) and at Bombay (1,027).

The highest mortality in any single station occurred in Quetta (8·31) and in Muttra (41·78). In 7 stations the ratios were between 20 and 30 per 1,000, in 35 between 10 and 20, and in 11 under 10. The chief causes of death at Quetta were cholera, dysentery, and respiratory diseases, and at Muttra enteric fever and cholera. The greater mortality at Muttra as compared with the previous year was due to enteric fever and cholera.

During the year under review 9,433 men of the Bengal Army, or 26·93 per cent. of strength, were located in the Hills. These men were not so healthy as in the previous year; for the admission-rate was 1,395, and the death-rate 9·50 against 1,201

and 5·91 per 1,000. The admission-rate was above, and the death-rate below, the decennial averages.

The health statistics of the troops of the Rajputana, Malwa, Sind, and Aden group were on the whole not unfavourable. Both the admission and death-rates (1,503 and 14·97 per 1,000) were below the decennial averages of 1870–79. The admission-rate was lower and the death-rate higher than in the previous year. The increase of mortality was under the heads of enteric fever, sunstroke and apoplexy, and dysentery. The chief diseases causing admissions were, in order,—fever, venereal diseases, wounds and accidents, abscess and ulcers, respiratory diseases, and diarrhœa. The chief causes of death were enteric fever (3·19), sunstroke and apoplexy (2·40), cholera, dysentery, phthisis, and violence (1·20 each). The largest stations included in this group are Mhow and Aden. The former recorded an admission-rate of 1,261 and a death-rate of 10·26; the latter an admission-rate of 1,178 and a death-rate of 15·67 per 1,000. The increase of mortality at Mhow was due to fevers. At Aden sunstroke and phthisis were the only diseases that caused more than one death each.

The health statistics of the troops in the Deccan and Nagpur were favourable. The admission-rate (1,168 per 1,000) was lower than that of the previous year and than that of the decennial period. The death-rate (9·67) was lower than the decennial average, but somewhat higher than in the previous year. The chief causes of admission were, in order,—fevers, venereal diseases, wounds and accidents, abscess and ulcer, rheumatic affections, respiratory affections, diarrhœa, and dysentery. The chief causes of death were, in order,—enteric fever, violence, other fevers, dysentery, respiratory diseases, and hepatitis. Secunderabad, the largest military cantonment in India, with an average strength of 2,489, and Poona with an average strength of 1,145, are included in this group. At Secunderabad the admission-rate was 1,133 and the death-rate 10·45: at Poona the admission-rate was 1,366 and the death-rate 12·23.

The statistics of the Southern India group were very favourable. The admission and death-rates (1,157 and 6·88) were both lower than those of the decennial period 1870–79; and the death-rate was lower than that of the previous year (7·73). Enteric fever and hepatitis were the chief causes of mortality. The largest stations of this group are Bangalore, Bellary, Cannanore, and Madras. At Bangalore, with an average strength of 1,159, the admission-rate was 1,048, and the death-rate 3·45; at Bellary, with an average strength of 954, the admission-rate was 1,460, and the death-rate 5·24 per 1,000.

As compared with those of the previous year, the health statistics of the Burma and Pegu group were not favourable. The admission-rate (1,215 per 1,000) was higher than the decennial average by 123 per 1,000; the death-rate (12·52), though higher than that of the previous year, was lower than the decennial average. The diseases giving rise to higher admission-rates were cholera, enteric fever, apoplexy and sunstroke, diarrhœa, respiratory diseases, venereal diseases, eye-diseases, and wounds. Those giving rise to increased mortality were cholera, enteric fever, other fevers, apoplexy and sunstroke, heart-disease, phthisis, and injuries. There were two deaths from enteric fever against none in the previous year,—one at Rangoon and one at Thayetmyo. The other two stations in the group are Toungoo and Port Blair. The highest admission-rate was 1,452 at Toungoo, and the highest death-rate 14·84 at Thayetmyo.

The average strength of the men located in the hill stations of Madras and Bombay was 584 against 757 in 1884. The admission-rate, 1,447 per 1,000, was less than that of the previous year and than the decennial average. But the death-rate was 18·84 against 5·28 in 1884, and a decennial average of 15·16 per 1,000. The increase of mortality was under the heads of enteric and other fevers, hepatitis, respiratory diseases, and violent deaths out of hospital. There were 5 cases of enteric fever with 2 deaths.

Cholera.

Throughout the Army of India 199 cases of cholera were treated, or a proportion of 3·5 per 1,000 of strength. Of this number 122 died, or 61·31 per cent. of those attacked. The prevalence of the disease among the European troops was greater than in any of the preceding three years. But the type of the disease was less virulent; for in 1884 there were 71·33 deaths in each hundred cases treated, in 1883 there were 62·20, and in 1882 there were 62·24. The average admission-rate for the decennial period 1870–79 was 4·7, and the average per-centage of deaths to seizures 69·11 per 1,000.

Of the total (199) number of cases of cholera treated, no less than 129 occurred in the Bombay Army, giving an admission-rate of 11·3 per 1,000 in that army against a decennial average of 2·1. It has already been noted that the disease appeared chiefly among the troops occupying Southern Afghanistan. Among these troops 117 cases were treated, or 70 per 1,000 of strength, with 71 deaths, or a per-centage of 60·68 among those attacked. The disease was therefore more prevalent, but less fatal than in the previous year, when 49 cases occurred, of which 79·59 per cent. proved fatal. No less than 115 cases with 69 deaths occurred at Quetta. The per-centage of fatality for the decennial period 1870–79 for the Bombay Presidency was 73·27.

Among the troops of the Bengal Presidency 64 cases of cholera occurred, a proportion to strength of 1·8 per 1,000 against the decennial average of 5·9. Forty-one cases proved fatal, a proportion of 64·06 per cent. of cases treated, the decennial per-centage being 70·26. The disease was less prevalent, but slightly more fatal than in the previous year, in which the admission-rate was 2·1, and the per-centage of deaths to cases 63·38. The greatest number of admissions was at Lucknow,—7 cases with 1 death; and the greatest number of deaths occurred at Gwalior,—5 cases with 5 deaths.

Only 6 cases of cholera occurred in the Madras Army, yielding a ratio of 0·6 per 1,000 against the decennial ratio of 2·9, Of those attacked two died, a per-centage of 33·33 against the decennial per-centage of 58·49. Four of the cases and one of the deaths occurred at Secunderabad.

Among the troops of the several geographical groups of the Bengal Army there was no cholera in the Hill Stations group. It was most prevalent in Bengal Proper and in the Gangetic Provinces. The Punjab, which was entirely free from the disease in the previous year, had 11 cases (at Mooltan, Rawalpindi, and Nowshera) with 9 deaths, a per-centage of 81·82 deaths to cases treated. Among the other groups, Bengal Proper and Agra and Central India were the only ones that recorded higher admission-rates than in the previous year. The admission rate of the former group was also higher than the average of 1870–79. The ratios of all the other groups were lower than those of either of the decennial periods. In Bengal Proper there were 6 cases with 5 deaths,—a per-centage of 83·33 deaths to cases treated. Five cases with 4 deaths occurred at Fort William, and 1 fatal case at Barrackpore. Cholera continued to diminish in the Gangetic Provinces, but that group maintained its evil pre-eminence. There were in it 27 cases with 12 deaths,—a mortality of 44·44 per cent. in the cases treated. The number of men attacked was almost the same as, but the virulence of the disease was much less than, in 1884, when 71·43 per cent. of the cases died. The decennial per-centage for the group was 63·96. In the fourth, or Agra and Central India group, there were 10 cases with 8 deaths, or 80 per cent. of deaths to cases; the per-centage of 1870–79 being 72·38. In the Meerut and Rohilkund group there were only 4 cases with 3 deaths against 32 cases with 16 deaths in 1884.

Small-pox.

In 1885 only 12 cases of small-pox (0·2 per 1,000) occurred, and that without any deaths; whereas in the previous year there were 78 cases and 8 deaths. The decennial ratio of admissions was 0·7, and of deaths 0·10.

The admission-rate for intermittent fever for the whole Army of India fell from 487 in the preceding year to 471; but this ratio is still in excess of the decennial average of 1870–79, namely 389. The diminution in the general rate was due to a diminution in the Bengal and Madras rates, which more than counterbalanced the Bombay increase. In the Bengal Presidency only was the admission-rate (565 per 1,000) over the decennial average. In the high rate for Bombay (509 per 1,000) the evil influence of Southern Afghanistan is again apparent, one-third of the cases having occurred there.

Fevers.

The admission-rate for remittent and continued fevers sank to an unusually low point—48, as against 60 in 1884, and 162 for the decennial period 1870–79. In each Presidency the admission-rate was reduced, and in the Bombay Presidency the death-rate also was reduced.

Enteric fever.

It was clearly shown in the report for 1884 that the disease returned as enteric fever is no new disease, that the only change has been a change of diagnosis, and that

in proportion as the number of cases diagnosed as enteric increased, the ratio of deaths to cases treated decreased. The following is evidence to the same effect:—

	Army of India.						
	Admission Rates per 1,000.			Per-centage of Enteric in the Total Rate here given.	Per-centage of Remittent and Continued in the Total Rate here given.	Per-centage of Deaths to Cases of Enteric Fever treated.	Per-centage of Deaths to Cases of Remittent and Continued Fever treated.
	Enteric, Remittent, and Continued.	Enteric only.	Remittent and Continued only.				
1870–79	166·8	4·6	162·2	2·7	97·3	43·83	0·79
1880–85	78·0	8·4	69·6	10·8	89·2	36·51	1·22

The above table shows that, while in the second of the two periods the per-centage of the admission-rate due to enteric fever had increased from 2·7 to 10·8, there had been a decrease in the per-centage of deaths to cases treated from 43·83 to 36·51. There occurred, therefore, no new fatal form of fever, but merely a change of opinion with regard to the nature of the always existing fever. As the total amount of fever was not disturbed by the intrusion of any new kind of it, the diagnostic preference for enteric fever naturally resulted in a diminution of the ratio of fevers returned as remittent and continued, and therefore deaths occurring under this head would tell more. Accordingly, we find that in the second period, while the per-centage of the admission-rate due to remittent and continued fevers had diminished from 97·3 to 89·2, the per-centage of deaths to cases treated had risen from 0·79 to 1·22.

Again, it happens that the total of the admission-ratios for enteric fever, plus remittent and continued, is the same in 1885, and 1882, and almost the same in 1883; so that we can compare those years:—

	1885.		1882.		1883.	
	Per 1,000.	Per-centage of Deaths to Cases treated.	Per 1,000.	Per-centage of Deaths to Cases treated.	Per 1,000.	Per-centage of Deaths to Cases treated.
Enteric - - -	11	30·31	6	40·90	8	31·00
Remittent and Continued -	48	1·44	53	1·16	50	0·84
Total - -	59	—	59	—	58	—

Comparing 1885 with 1882, we see that the increase of enteric is exactly counterbalanced by a decrease of remittent and continued, and is accompanied by a diminution in the per-centage of deaths to cases treated for enteric, and a slighter increase in the per-centage of deaths to cases treated for remittent and continued. If we take into account intermittent fever also, we obtain the following comparison for the same three years:—

	1885.	1882.	1883.
	Admissions per 1,000.	Admissions per 1,000.	Admissions per 1,000.
Enteric - - - -	11	6	8
Intermittent - - - -	471	494	359
Remittent and Continued - - -	48	53	50
Total - - -	530	553	417

The decrease in the total fever ratio in 1885, as compared with 1882, was entirely due to the smaller ratio of intermittents—smaller by 23 per 1,000; while the increased

enteric ratio was completely balanced by the diminished remittent and continued ratio. Translating the above into per-centages, we obtain :—

	1885.	1882.	1883.
Enteric	2	1	2
Intermittent	89	89	86
Remittent and continued	9	10	12
Total	100	100	100

This table shows per-centages of the total ratio per 1,000. Comparing 1885 with 1882 we see the per-centage of intermittent stand fast, while the increase in that of enteric is exactly compensated by a decrease in that of remittent and continued. In 1883, as compared with 1882, there was an increase both in enteric and remittent, balanced by a decrease in intermittent. It is well known that there is often confusion in the returning of intermittents and remittents. The return of remittents may, therefore, vary in two directions,—towards enteric or toward intermittent; so that we cannot always expect to find enteric and remittent *exactly* counterbalance each other, though the increase of one is accompanied by a decrease of the other. In the Bengal Presidency, in 1885, the enteric ratio rose in the same proportion above the average of 1881–85, as the remittent and continued ratio sank below it. Finally, it may be stated that, both in the case of India, and of the separate presidencies, an increase or decrease of enteric fever is in many years coincident with an increase or decrease of the admittedly malarious fevers, showing that they are all more or less under the same causative influences. When all are simultaneously increased or diminished, it is of course less easy to show the counterbalancing of enteric with remittent and continued; but that such counterbalancing even then occurs the examples given above leave no room to doubt.

In the following table the admission and death-rates for enteric and other fevers in the three Presidencies are contrasted :—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870–79*	5·3	607·3	612·6	2·28	1·74	4·02	3·9	266·5	270·4	1·42	0·62	2·04	3·1	659·9	663·0	1·75	1·14	2·89
1880†	8·7	809·6	818·3	3·07	2·66	5·73	2·6	450·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881†	6·3	763·9	770·2	2·62	0·81	3·43	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8	2·83	0·91	3·74
1882	7·3	600·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	558·5	563·6	1·90	0·81	2·71
1883	8·1	486·4	494·5	2·52	0·44	2·96	8·6	128·4	137·0	2·86	0·28	3·14	5·7	436·4	442·1	1·55	0·73	2·28
1884	12·6	682·8	695·4	3·31	0·36	3·67	11·4	166·0	177·4	1·67	—	1·67	9·1	504·4	513·5	2·05	2·14	4·19
1885	14·0	611·0	625·0	4·05	0·63	4·68	6·4	149·4	155·8	2·19	0·19	2·38	7·3	577·5	584·8	2·54	1·49	4·03

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

Both enteric and other fevers were more prevalent in the Bengal Army than in those of Madras and Bombay. As in the case of the Army of India as a whole, so in the Bengal Army the increase of enteric in 1880–85, as compared with 1870–79, was accompanied by a decrease in remittent and continued fevers, and by a fall in the per-centage of deaths to cases treated for enteric. The high rate of admission of 1884 for enteric fever in the Bengal Army, 12·6, was surpassed by that of the year under review, namely, 14·0 per 1,000, the decennial average being 5·3. The admission-rate for other fevers fell from 683 to 611, the decennial average being 607. The next highest admission-rate for enteric fever was recorded in the Bombay Army, where again the increase of enteric in 1880–85, as compared with 1870–79, was accompanied by a decrease in remittent and continued fever ratios, and a fall in the per-centage of deaths to cases treated for enteric. The Bombay rate is, however, less than that of the previous year, and only about half that of Bengal, and the rate for other fevers, though greater than in the previous year, was below the decennial average. In the Madras Army the ratio of admissions for enteric fever was 5 per 1,000 less than in

the previous year, but was still 2·5 per 1,000 above the decennial average. The ratio of admissions for other fevers was also considerably less than in the previous year, and much below the decennial average. Looking next to the total admission and death-rates in the three armies for both enteric and other fevers together, it will be observed that, as in the previous year, in the Bengal Army alone does the combined admission-ratio of the year under report exceed the decennial average of 1870–79; while in all three combined the total death-rate is over the decennial average. In Bombay alone is the total combined death-rate less than in the preceding year. This decrease in Bombay is entirely due to decrease in the mortality from fevers other than enteric. In Bengal the increase over the previous year was 1·01, of which enteric contributed 0·74, and other fevers 0·27; while in Madras the increase was 0·71, of which enteric contributed 0·52 and other fevers 0·19 per 1,000. The increased combined mortality in Bengal was not in proportion to the increase of admissions from enteric, the increased mortality in Madras was in spite of a decrease in admissions for enteric; and the decreased mortality in Bombay was accompanied by a decrease in admissions for enteric.

The following table is introduced to show the fluctuations in the death-rates from enteric and other fevers during the years 1871–85:—

Presidencies.	Fevers.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.	1883.	1884.	1885.
Bengal	Intermittent, remittent, and continued.	2·25	1·78	1·39	1·10	1·18	0·71	0·66	1·59	2·63*	2·66*	0·81	0·77	0·44	0·36	0·63
	Enteric	1·71	1·62	1·53	2·01	1·59	1·75	1·55	4·69	3·86*	3·07*	2·62	2·90	2·52	3·31	4·05
	Total	3·96	3·40	2·92	3·11	2·77	2·46	2·21	6·28	6·49*	5·73*	3·43	3·67	2·96	3·67	4·68
Madras	Intermittent, remittent, and continued.	0·83	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27	0·28	—	0·19
	Enteric	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86	1·67	2·19
	Total	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14	1·67	2·38
Bombay	Intermittent, remittent, and continued.	1·01	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81	0·73	2·14	1·49
	Enteric	1·48	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83	1·90	1·55	2·05	2·54
	Total	2·49	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·09	3·74	2·71	2·28	4·19	4·03

* Excluding troops in Afghanistan.

The approximate total average for Bengal for the 15 years was 3·84, which was exceeded in the years 1871, 1878, 1879, 1880, and 1885. In Madras the average of 2·02 was exceeded in 9 years out of the 15. In 6 out of the 15 years,—1878, 1879, 1880, 1881, 1884, and 1885,—the average of 3·31 was exceeded in Bombay. The main results of the foregoing tables are brought together in the following table for facility of comparison:—

	During 1870–79.			During 1880–85.			During 1885.		
	Enteric fever.	Other fevers.	Total of both.	Enteric fever.	Other fevers.	Total of both.	Enteric fever.	Other fevers.	Total of both.
Army of India	2·03	1·42	3·45	2·90	0·03	3·93	3·41	0·72	4·13
„ Bengal	2·28	1·74	4·02	3·19	1·13	4·32	4·05	0·63	4·68
„ Madras	1·42	0·62	2·04	1·79	0·22	2·01	2·19	0·19	2·38
„ Bombay	1·75	1·14	2·89	2·72	1·53	4·25	2·54	1·49	4·03

These tables show that the total mortality from all forms of fever does not on the whole materially differ from what it was 13 years ago, and this is hardly compatible with the view that a new and fatal fever has recently been introduced into India. Either enteric fever has existed all along in this country, or it does not now exist.

The relationship between enteric fever and age is exhibited in the following table:—

Year.	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	1·04	9·1
1879	6·17	54·1	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14
1883	4·34	66·36	1·50	22·94	0·70	10·70
1884	4·61	62·05	1·83	24·63	—	—
1885	5·16	61·06	2·30	27·22	0·74	8·76

The results given do not differ materially from those of recent years, and their significance has been repeatedly indicated in recent annual reports.

As with age, so with length of service in India, the disease stands in well-defined relationship. With increased service in India liability to become affected by enteric fever rapidly diminishes.

Statement showing the proportion of men who have served in India two, five, and seven years from 1871–85.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1879	32·1	60·9	72·6
1872	33·7	66·7	80·0	1880	33·4	65·4	77·2
1873	31·5	65·5	79·6	1881	38·9	70·4	81·1
1874	25·9	64·3	79·8	1882	33·1	71·9	82·9
1875	26·1	60·1	81·0	1883	32·3	74·7	85·5
1876	25·5	57·6	75·1	1884	36·2	75·0	86·2
1877	25·2	56·2	72·6	1885	36·6	73·0	86·8
1878	28·9	59·8	73·0				

Statement showing the death-ratios of the European Army from Enteric Fever at different periods of residence in India, together with Ratios of Liability to it, for 1877–85.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at Different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	3·31	59·5	1·35	24·2	0·90	16·1
1878	7·90	63·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·08	75·98	1·78	14·90	0·47	3·93
1881	4·55	60·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44
1883	4·98	70·34	1·55	21·89	0·55	7·77
1884	5·47	70·04	1·55	19·85	0·46	5·89
1885	6·55	68·87	1·93	20·29	0·38	4·08

As a rule, the medical officers who reported on the enteric fever of the various stations were unable to attribute it to any definite cause. The irregularity of the disease as to course, progress of temperature, presence or absence of eruption, presence of diarrhœa, enlargement of the spleen is noted, as well as to the distribution, nature, and extent of the intestinal lesions observed after death. As a rule also, they were struck by the way in which the disease was dominated by climatic influence.

Brigade-Surgeon Bradshaw, the Administrative Medical Officer at Quetta, doubts the existence of malaria at that station, and believes that the enteric fever is "autogenetically" developed "by great chills exciting fermentative changes in man's "own intestines." The following table shows the prevalence of fevers in Quetta during the last four years :—

	*1882.		*1883.		1884.		1885.		Average of the Four Years.	
	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.
Enteric fever	12·9	3·23	11·6	4·83	29·6	9·27	9·5	2·71	15·5	4·87
Intermittent fever	265·9	—	252·4	—	484·7	—	1,277·4	—	645·8	—
Remittent and continued fevers	74·3	—	18·4	—	282·7	5·56	62·9	4·74	107·5	2·88
Total	353·1	3·23	282·4	4·83	797·0	14·83	1,349·8	7·45	768·8	7·75

* Including Gulistan for a short period.

There appears to have been a great outburst of what is called malaria in 1884, characterised by a high proportion of serious cases. In the following year (1885) there was a great subsidence of virulence; but ordinary ague cases went on increasing in frequency, so much so that at the end of the year the ratio of admissions to strength was $2\frac{1}{2}$ times greater than in 1884. The strength of the European troops at Quetta in those four years was respectively, 929, 1,034, 1,079, and 1,478 per 1,000. It will be observed that the enteric fever ratio rose with the malarial fever ratio in 1884, and fell with the remittent and continued fevers ratio in 1885, showing the same strikingly sudden rise and fall as the remittent and continued fevers ratio. Once more we have met with statistical confirmation for the opinion that the severer forms of fever are closely connected with one another, in the influences which they obey, whatever they may be called.

"Regarding Quetta," writes the Surgeon-General, Bombay, "I have always under-"stood that this cantonment was found comparatively healthy at the time of its first "occupation, and that it is only within the last two or three years that so much "sickness has prevailed. The climate of Quetta (distinguished for its great extremes "of temperature), was the same, I presume, then as now, and if so, there must be "another factor (whatever it may be) responsible for the occurrence of the febrile "and other diseases now so prevalent, besides mere climate changes or chills. It has "frequently been observed that some of our sanitaria in India, when first occupied, "were very healthy, but in course of a few years became hot-beds of enteric and "cholera. This, in a great measure, is due to the soil and water becoming defiled "by our own neglect of the simplest sanitary precautions, in permitting Natives and "Europeans to defile the ground. Owing to the absence of sufficient means, it was "impossible to insist on a high state of sanitary efficiency at Quetta during the "earlier years of its occupation; the latrine accommodation was quite inadequate, "especially for the wants of the Natives, and the whole ground must have become "saturated with filth. Moreover, the bad housing of the troops must have had a very "prejudicial effect on their health."

Bowel complaints.

Both dysentery and diarrhœa were more prevalent in the army as a whole than during the previous year, but in the case of each the ratio was lower than the decennial average. The severity of the cases of dysentery treated was greater than in the previous year, the per-centage of deaths to cases treated being 2·80 against 1·31: the decennial per-centage was 3·65. Diarrhœa was of a less severe type, the per-centage of deaths having been 0·10 against 0·18: the decennial per-centage was 0·19. Dysentery was most prevalent, as usual, in the Madras Army, but it caused the largest proportion of deaths to strength in the Bombay Army. It is notable that

10·15 per cent. of the cases treated in the Bombay Presidency terminated fatally, against 1·40 in the Bengal and 0·71 in the Madras Presidency. This is due to the inclusion of the statistics of Southern Afghanistan in those of the Bombay Presidency. Diarrhœa was most prevalent in Bengal and most fatal in Bombay.

Apoplexy.

Apoplexy and sunstroke gave rise to an admission-rate equal to that of the preceding year, namely, 3 per 1,000, but to a smaller death-rate, namely, 0·86 per 1,000 against 1·09.

Hepatitis.

In the Army, as a whole, the reduction in the admission and death-rates from hepatitis, which has been continuing since 1880 or 1881, was maintained in 1885. Compared with the previous year, the admission-rate in Bombay (18 per 1,000) remained the same, while the death-rate (0·70) was diminished; in Bengal and Madras the admission-rates (21 and 33 per 1,000), were less by 5 and 3 per 1,000 respectively, the death-rate in the latter (1·04) being diminished, and in the former (0·88) practically unchanged. The average mortality caused by this disease in the Army in the period 1870–79 was nearly two and a half times as great as that of the year under review,—2·19 against 0·88 per 1,000. This fall in mortality is observable in all three presidencies, the difference being 2·12 in Madras, 1·16 in Bengal, and 1·01 in Bombay.

Respiratory diseases.

It is very satisfactory to observe a marked fall in the admission-rate for respiratory diseases in the Army of India as a whole, a fall of 8 per 1,000 from the rate of the previous year. The admission-rate for the year (65 per 1,000) under report was also 10 per 1,000 less than the average of the decade 1870–79. The mortality (0·88), however, was higher than in the previous year (0·73), mainly due to the influence of the Southern Afghanistan statistics.

The Madras Presidency alone shows an increase in the admission and death rates (51 and 0·38 per 1,000 respectively against 46 and 0·09 in 1884), and this increase was chiefly due to the inclusion of the comparatively high statistics of Burma and Pegu. Similarly the high ratios recorded in the Bombay Army (67 and 1·93 per 1,000), were due to the influence of the returns from Southern Afghanistan. The admission and death rates in this portion of the Bombay Army were 136 and 8·37 against 67 and 1·93 per 1,000 for the Bombay Army as a whole. In the Bombay Army alone was the admission-rate higher than the decennial average, but it was, nevertheless, 15 per 1,000 less than the rate of the previous year. Both in Madras and Bombay the death-rate was greater than that of the previous year, and greater than the decennial average. In all the groups of the Bengal Army, except the Hill stations and Bengal Proper, the admission-rate was less than in the previous year, and for the Presidency as a whole the admission and death rates were 68 and 0·69 per 1,000 against 79 and 0·72 in 1884.

Venereal disease.

A separate memorandum on the subject of venereal disease in the Army of India will be found in an Appendix (p. 97). The progressive increase in the admission-rate was accentuated in 1885. This increase was most marked in the Bengal Presidency, and though Bombay showed a decrease, the rate was still very high as compared with former years.

Admissions from Venereal Diseases in the three Presidencies.

Presidency.	Admissions per 1,000.							
	1860–69.	1870–79.	1880.	1881.	1882.	1883.	1884.	1885.
Bengal	265	209	276*	276*	271	281	291	363
Madras	†	198	275	258	288	289	307	350
Bombay	†	191	269	261*	224	218	292	272
India	†	203	250	260	265	270	294	343

* Excluding troops in Afghanistan.
† The statistics of Madras and Bombay, and for the whole of India for these years are not available.

All three forms of venereal disease gave rise to much higher rates than those which prevailed during the last decade. Syphilis, both primary and secondary, and gonorrhœa, gave rise to a larger proportion of admissions than during the preceding year, as the following table shows:

ARMY OF INDIA.

Venereal Admissions of 1884 *and* 1885 *compared.*

VENEREAL DISEASES.	1885. Strength, 57,146.		1884. Strength, 55,349.	
	Admissions into Hospital.	Rate per 1,000.	Admissions into Hospital.	Ratio per 1,000.
Primary syphilis	6,972	122·1	4,992	90·2
Gonorrhœa	8,987	157·3	7,982	144·2
Phimosis	62	16·2	58	17·0
Stricture of urethra	202		199	
Warts	440		457	
Orchitis (gonorrhœal)	223		228	
Total	16,886	295·6	13,916	251·4
Secondary syphilis	1,638	28·7	1,352	24·4
Inflammation of inguinal glands	971	26·5	893	25·9
Orchitis	542		542	

Phimosis, stricture, warts, gonorrhœal orchitis, and non-gonorrhœal orchitis were all prevalent to practically the same extent as in the preceding year. Secondary syphilis gave rise to an admission-rate of 28·7 per 1,000, or 4·3 greater than in 1884. Up to 1884, and since 1876, the ratios of admissions for this form of venereal disease remained remarkably constant, varying from 22 to 25 per 1,000, while the admission-rates for primary syphilis fluctuated between 60 and 96.

The total admission-rate for all forms of venereal disease in the Bengal Army was 371 per 1,000. Primary syphilis gave rise to an enormously increased proportion of admissions, namely, to 129 per 1,000 against 87 or 88 in each of the preceding three years. The admission-rate for gonorrhœa increased from 147 to 171, and that for secondary syphilis from 25 to 32.

The admission ratio for primary syphilis in the Madras Army rose from 102 in 1884 to 124 per 1,000 in 1885. The ratios for secondary syphilis fell from 26 to 22, the same rate as that of 1883. The year 1878 is the only year in which a lower rate for secondary syphilis was recorded. As stated in last year's report, the secondary syphilis ratios for Madras fluctuate as compared with those of Bengal. The gonorrhœa ratio was higher than in any other year of the series, as was also the total venereal rate.

In the Bombay Army the total venereal ratio (276 per 1,000) was less than that of the previous year and than that of 1879, but greater than all the other ratios of the series. There was a decrease under each head of disease, except under primary and secondary syphilis. The increase under each of those two heads was considerable, and places the primary syphilis ratio of 1885 (99) nearly at the head of its series, it having only been exceeded by that of 1879, while the secondary syphilis ratio (26) was greater than in all the years except 1874, 1875, 1876.

A comparison of venereal disease in the three Presidencies shows that primary and secondary syphilis and gonorrhœa gave rise to a larger proportion of admissions in the Bengal Army than in the other two Presidencies. Madras took the second place with regard to primary syphilis and gonorrhœa, Bombay the second place with regard to secondary syphilis. In the following table the admission ratios for syphilis and gonorrhœa in the three armies of India are compared with those of 1872:—

Admission Rates from Primary and Secondary Syphilis and Gonorrhœa for 1885 *compared with Rates of* 1872.

	PRIMARY SYPHILIS.			SECONDARY SYPHILIS.			GONORRHŒA.		
	1885.	1872.	Difference.	1885.	1872.	Difference.	1885.	1872.	Difference.
Bengal Army	129·3	61·9	+67·4	31·6	22·6	+9·0	171·5	87·2	+84·3
Madras „	123·7	65·4	+58·3	21·9	29·2	−7·3	155·1	61·5	+93·6
Bombay „	98·7	54·4	+44·3	25·9	14·0	+11·9	116·8	75·7	+41·1

It will be seen that the results of the present year are in all cases, with the single exception of secondary syphilis in the Madras Army, less favourable, and often very considerably less favourable, than those of 1872.

Invaliding.

Throughout the army of India 1,303 men were invalided, or 22·81 per 1,000 of strength. This ratio is below those of the four preceding years, and 20·23 below the last decennial average. It is the lowest ratio on record since 1870, the next lowest having been 26·31 in 1880. The proportion of invalids contributed by the Bombay Presidency is highest, due to the influence of Southern Afghanistan; and that contributed by the Bengal Presidency is lowest.

Forty per cent. of the total number of men invalided from the Army of India were discharged as unfit for further service. This proportion was higher than usual, but less than in the previous year (41 per cent). The proportion of invaliding for discharge was greater than in the previous year only in Madras (47 against 36), the chief causes being phthisis and secondary syphilis; and it was greater than in either of the other two presidencies, Bengal coming next with 43, while for Bombay the proportion was only 29 per cent.

Percentage of those invalided for discharge in total number invalided.

—	1881.	1882.	1883.	1884.	1885.
Army of India -	35	37	39	41	40
„ Bengal -	43	40	45	45	43
„ Madras -	32	38	40	36	47
„ Bombay -	17	26	21	33	29

In each Presidency the highest ratio was given, as usual, by anæmia and debility, 2·53 in Bengal, 2·70 in Madras, and 7·13 in Bombay. In Bengal the next highest ratios were, in order, those of phthisis (2·11), hepatitis, heart-diseases, palpitation, mental diseases, &c.; in Madras those of dysentery (2·51), hepatitis, phthisis, and mental diseases, secondary syphilis, &c.; in Bombay those of hepatitis (2·23), phthisis, heart-diseases, mental diseases, &c.

The invaliding from mental disease in the Army of India was less than in the previous year, the total number of cases being 75 against 88 in 1884. The reduction was due only to the greatly lessened number in Bengal, there having been an increase in the other two Presidencies, especially Bombay. In Bengal the diminution was most in dementia, 9 cases to 27; in Bombay the increase was specially in mania and melancholia. Melancholia was the prevailing form of alienation in the Bengal and Madras Presidencies, mania in the Bombay Presidency.

In regard to invaliding with reference to age, the per-centage of those under 25 years to the whole number invalided was 42·13 for the Army of India. This is larger than the per-centages of the preceding two years, 38·70 and 36·55, which were themselves unusually high. The per-centage between 25 and 29 was also higher; but the per-centage above 30 was considerably lower. There has been of late years an increase of the per-centage of men under 25 in the strength of the Army, and a decrease in the per-centage of those over 30.

Next as regards the influence of length of service in India upon invaliding, the following table shows that a residence of from two to five years is the time during which the largest proportion of men break down. In 1885 the per-centage of men under two years' service to the whole number invalided (22·56) was somewhat reduced (though still greater than in 1883 and 1882); but in a greater proportion the per-centage of men between two and five years' service (54·64) was increased. The per-centages of men in the Army of India up to five years' residence during 1885 was 73 against 75 in 1884, and the per-centage of those men invalided to the whole number was 77·20 against 74·16. With gradual increase in the number of men of such service, there was a corresponding increase in the proportion of men of that service invalided up to 1883. In 1884, with a stationary per-centage of men of such service, there was a fall in the per-centage of invalids furnished by them; while in 1885 a fall in per-centage of men of not more than five years' residence was accompanied by a disproportionate increase in the per-centage of invalids from among them.

Number of Men under Two Years' and between Two and Five Years' Service invalided per cent. of Total Number invalided.

Service.	1885.	1884.	1883.	1882.	1881.
Under 2 years -	22·56	24·19	18·94	17·35	23·38
2 to 5 years - -	54·64	49·97	57·81	57·30	48·37

Table showing per-centages of Men up to Five Years' residence in the Army of India, and per-centages of these Men invalided to Total invalided.

Residence.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.
0 to 5 years' residence -	73	75	75	72	70	65	61	60
Invalided - - -	77·20	74·16	76·75	74·65	71·75	67·66	59·94	53·01

The statistics given in the following table differ from those of 1884, and show a higher general sick and death-rate among new regiments than in the Army generally,—a higher mortality from enteric and other fevers.

Experience of Newly-arrived Regiments in 1885 (*during their First Year of Indian Residence*).

—	Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily Sick-rate.	Death-rate.	Deaths from				
					Enteric Fever.	Other Fevers.	Apoplexy.	Dysentery and Diarrhœa.	Hepatitis.
Army generally -	56,967	1532·7	70·7	14·55	3·41	0·72	0·86	0·91	0·88
New regiments -	1,684	1614·0	59·6	17·22	7·72	1·19	0·59	0·59	1·19

It is unusual, as compared with the period 1870-79, that there should have been more hepatitis and less sunstroke and bowel disease among the new regiments than in the Army generally.

Sickness and mortality among women and children.

In 1885 there was again an increase in the numbers of women and children in the European Army of India, the rise in the number of children being more considerable than that in the number of women.

A death-rate of 12·87 per 1,000 in an average strength of 3,419 women is very favourable both absolutely and as compared with the death-rate of the preceding year, which was 17·50, and with 25·09, the death-rate of the 10-year period 1870-79. Child-birth and abortion as usual gave rise to the largest proportion of deaths—2·63 per 1,000; but the proportion in 1884 was 2·97, and in the 10-year period 2·93. The next most frequent causes of death were enteric fever (1·47), remittent fever (1·17), and apoplexy and sunstroke (1·17). Enteric fever was credited with 5 deaths, the same number as in 1884. Remittent and continued fevers alone among the chief causes of mortality gave rise to a higher death-rate than in the preceding year. The death-rates from enteric fever, diarrhœa, hepatitis, and heart diseases remained unchanged; while the rates from all the other chief causes of mortality were diminished. Compared with 1884, the mortality of the women of the Bengal and Bombay Presidencies was lower, while that of the women of the Madras Presidency was higher. The mortality in the Bengal Presidency was the highest, but it only exceeded that of Madras by 0·09, and that of Bombay by 2·39 instead of, as in 1884, by 11·97 and 10·32 per 1,000. The death-rates in the three Presidencies were—Bengal 13·34, Madras 13·25, Bombay 10·95, against 22·53, 10·56, and 12·21 in 1884. In Bengal the greatest cause of mortality was child-birth and abortion; in Madras the same and heart diseases; in Bombay child-birth and abortion and enteric fever. The average number of children in the

Army of India was 6,632 against 6,453 in the previous year; the number of deaths 307 against 354; the death-rate 46·29 against 54·86 in 1884 and 68·96 in the 10-year period 1870–79.

Mortality among officers.

Among the 6,410 officers of the Army of India as a whole 78 deaths occurred, equivalent to 12·17 per 1,000 against 9·17 in 1884. Amongst the officers of the British service the ratio was 12·5, and of the Indian service 11·8, against 10·30 and 8·11 per 1,000 respectively during the previous year. All these ratios are therefore less favourable than those of 1884.

Native Troops.*

Sickness and mortality in 1885.

The health of the Native Army of India, as a whole, was favourable in 1885. All the rates were more favourable than those of the quinquennial period 1877–81, and the admission and daily sick ratios were an improvement upon those of 1884, but the mortality was higher than in any of the three preceding years. The increased mortality was partly due to cholera, especially among the troops serving in Southern Afghanistan. The total mortality ratio, 13·67 per 1,000, was less than that of the European Army (14·55), and was nearly two and a half times less than that of the jails of India (33·54). The ratio of deaths from cholera, though higher than in any of the preceding five years, was lower than the average of the quinquennium 1877–81.

Sickness and Mortality during the years 1877 *to* 1885 *compared.*

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81 -	118,669	1,422	48	1·94	24·90	27·40
1877 - -	113,966	1,030	32	1·53	10·90	13·38
1878 - -	117,273	1,460	43	2·06	18·04	21·02
1879 - -	121,107	1,735	58	4·61	35·15	37·79
1880 - -	126,385	1,545	56	0·53	39·22	41·12
1881 - -	114,612	1,305	46	0·97	19·24	22·62
1882 - -	114,894	1,129	37	1·02	12·24	14·76
1883 - -	114,830	923	31	1·15	11·76	14·31
1884 - -	114,827	1,042	33	0·71	10·50	12·22
1885 (*a*) -	115,486	978	32	1·61	13·67	16·09

(*a*) Excluding men on active service in Burma.

Malarial fevers were, as usual, the most frequent causes of admission into hospital, giving rise to a ratio of 431·0 per 1,000 against 503·2 in 1884. Of the 20 chief causes of admission, 12 (including cholera, remittent fever, dysentery, diarrhœa, and respiratory diseases) gave rise to higher ratios than in 1884, 6 (including intermittent fever, hepatitis, and guinea worm) to lower ratios, and 2 (enteric fever and dropsy) to the same ratios as in 1884. The cholera admission-rate was higher than in any of the preceding five years. That of enteric fever was exactly the same as in the preceding four years, but the disease was less fatal than in 1884, 44·44 per cent. of those treated having died against 61·11 per cent. in that year. During 1883 the per-centage of deaths among those attacked was 27·78, the lowest on record since 1877, and the next highest ratio to that of 1884 was that of 1882, namely, 58·33. Malarial fevers were less prevalent than in any of the preceding five years, except 1883; bowel diseases were more prevalent than they have been in any year since 1881; and respiratory diseases more prevalent than in the two preceding years. The chief cause of mortality in the Native Army is usually respiratory disease, and during 1885 it caused 3·74 per 1,000 of the total mortality. This ratio is lower than that of any of the preceding five years, except 1884. Next to respiratory diseases, fevers contributed most largely to mortality (2·20), and next in order cholera (1·61), dysentery (0·75), phthisis (0·69), anæmia and debility (0·55), and diarrhœa (0·54).

* (Excluding troops on active service in Burma, the returns for which are not complete.)

Sickness and mortality in the Bengal Army gave rise to smaller ratios than usual. In the following table it will be seen that the admission-rate of 1885 is lower than the decennial average, and lower than that of any single year here recorded except 1883; that 1883 is the only year in which a lower daily sick-rate was recorded; and that the death-rate in hospital was lower than that of the decennium and than that of any single year quoted:— Bengal Army.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		Mortality, including absent Deaths.
				Cholera.	All Causes.	
1867–76	39,508	360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	36,896	1,495	51	0·92	19·76	27·73†
1882	40,256	1,250	41	0·72	13·34	16·49
1883	40,932	985	32	0·56	10·55	13·98
1884	40,850	1,193	35	0·71	10·97	12·56
1885‡	40,753	1,076	34	0·29	10·11	14·18

* Excluding troops in Afghanistan.
† These ratios are calculated on the total regimental strength, including the army in Afghanistan.
‡ Excluding men on active service in Burma and Egypt.

Of the 20 chief diseases, 12 (including cholera, intermittent fever, dysentery, diarrhœa, respiratory diseases) caused a smaller proportion of admissions than in 1884, and 7 (including enteric fever, remittent and continued fever, phthisis, rheumatism, and venereal diseases) a larger proportion; while in the case of dropsy the ratio remained the same. The highest proportion of mortality was caused by respiratory diseases, the ratio being exactly the same (2·77) as in 1884. Mortality from cholera, fever, bowel disease, and hepatitis, was less than in 1884, while that from phthisis (1·13 against 0·98), anæmia and debility (0·37 against 0·34), heart disease (0·17 against 0·12), apoplexy (0·15 against 0·10), scurvy (0·24 against 0·08), &c., was greater. Of cholera 17 cases were treated, of which 12, or 70·59 per cent., terminated fatally.

The proportions in which the various geographical sections of the Army of Bengal contributed to the general admission and death-rate are shown in the following table:—

Year.	Ratio per 1,000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76	1,523	19·13	1,062	8·38	987	11·19	1,588	9·61	1,459	14·24
1877	1,492	19·64	768	5·19	642	9·52	906	7·41	1,248	8·85
1878	1,527	22·13	1,036	7·88	1,008	9·83	1,581	12·96	1,896	18·33
1879	1,816	25·57	1,658	11·05	2,038	36·17	2,303	16·07	2,173	47·64
1880	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	22·86
1882	1,569	18·22	1,081	10·01	1,083	9·98	1,248	7·18	1,268	13·30
1883	1,408	16·23	970	8·17	978	11·53	906	5·77	830	10·80
1884	1,367	14·61	929	6·00	1,188	10·62	1,312	7·84	1,083	8·49
1885	1,278	9·96	990	6·42	1,179	10·04	1,333	8·28	902	9·92

In all the groups, excepting the Meerut and Rohilkund, the admission-ratios of the year are below the averages of 1867–76. The ratios in the last-mentioned group have been above the decennial averages since 1878, with the single exception of 1883. In all groups the mortality-ratios are below the averages of the last decade. In Bengal Proper and Assam, and in Meerut and Rohilkund, the admission and death-rates were both lower, and in the Gangetic Provinces and in Agra and Central India higher than in 1884, while in the Punjab the admission-rate was lower and the death-

rate higher. The increased mortality in the Punjab was due mainly to cholera, dysentery, respiratory diseases, and hepatitis. In the case of the Gangetic Provinces the increased admission-rate was due to malarial fevers, bowel diseases, phthisis, and guinea-worm, and the increased death-rate to fevers, bowel diseases, and phthisis. In the case of Agra and Central India the increased admission-rate was due to apoplexy, respiratory diseases, venereal diseases, eye diseases, and abscess and ulcer, and the increased death-rate to respiratory diseases and bowel diseases.

The chief causes of sickness in the various geographical groups are set forth in the following table:—

Groups.	Ratio of Admission per 1,000 of Strength.					
	Fevers.	Bowel Complaints.	Spleen Diseases.	Respiratory Diseases.	Rheumatism.	Abscess and Ulcer.
Lower Bengal and Assam - -	589	136	9	67	56	84
Gangetic Provinces - -	471	74	5	42	42	101
Rohilkund and Meerut - -	547	57	11	50	38	143
Agra and Central India - -	776	50	6	47	33	121
Punjab - - - -	403	53	8	51	38	97

Compared with the ratios of 1884 fevers were more prevalent only in the Gangetic Provinces, where the increase was 125 per 1,000, and in Meerut and Rohilkund, where the increase was 17 per 1,000. Bowel complaints gave rise to higher ratios only in the Gangetic Provinces (increase 11 per 1,000), and in the Punjab (4 per 1,000). Respiratory diseases increased in the Punjab (by 6 per 1,000), in Meerut and Rohilkund (by 4 per 1,000), and in Agra and Central India (by 2 per 1,000). Rheumatism was more prevalent in the Punjab (by 11 per 1,000), and in Lower Bengal and Assam (by 1 per 1,000). Abscesses and ulcers occurred more frequently in all groups except the Gangetic Provinces, the greatest increase being 42 per 1,000 in Meerut and Rohilkund.

The chief causes of mortality in the several geographical groups in the Bengal Army are shown in the following table:—

Groups.	Ratio per 1,000.				
	Cholera.	Fevers.	Bowel Complaints.	Respiratory Diseases.	Total.
Lower Bengal and Assam - -	·35	2·10	1·22	·70	9·96
Gangetic Provinces - -	·47	1·41	·94	1·09	6·42
Meerut and Rohilkund - -	·55	2·19	·55	2·19	10·04
Agra and Central India - -	·22	1·79	1·34	3·14	8·28
Punjab - - - -	·06	2·31	·38	3·65	9·92

The cholera ratio in the Punjab rose from zero to 0·06, and in Meerut and Rohilkund from 0·19 to 0·55. In the other groups it fell,—most markedly in the Bengal Proper and Assam group. There was only 1 case, a fatal one, in the Punjab. The death-rate from fevers increased in the Gangetic Provinces, remained as before in the Punjab, and decreased in the other groups. But in 1884 all the ratios were higher as compared with 1883, except in the case of the Gangetic Provinces. The result is that, though three groups have lower ratios than in 1884, and only one a higner ratio, yet all the groups except Lower Bengal and Assam have still a higher fever mortality than in 1883. Bowel complaints caused greater mortality than in 1884 only in the Gangetic Provinces (by 0·94), and in Agra and Central India (by 0·28) per 1,000. The mortality from respiratory diseases decreased in the first and second groups; but unfortunately the increase in the other groups was marked,—no less than 2·29 per 1,000 in Agra and Central India, 0·87 in the Punjab, and 0·26 in Meerut and Rohilkund. Yet the Agra and Central India group is the only one which recorded a higher ratio than in 1883. The chief mortality of this group occurred at Morar.

Of the stations occupied throughout the year, nine recorded admission-rates of 1,500 to 1,998 per 1,000 against 12 in the previous year, the highest ratios having been recorded at Baxa, Gumbaz, Doranda, Delhi, Naga Hills, and Morar in the above order.

Four stations, occupied throughout the year by the regular troops of the Bengal Army, recorded mortality ratios exceeding 20 per 1,000 against 5 in 1884; viz.,—

Gumbaz, 50·31; Khelat-i-Killa, 45·77; Sipri, 23·26; Umballa, 21·11. At Gumbaz the average strength was 318, and 16 deaths gave rise to the ratio quoted: 8 of these were due to scurvy, 2 to anæmia, 2 to dysentery, and 2 to apoplexy. At Khelat-i-Killa the average strength was 568, and 26 deaths occurred, of which 12 were due to respiratory diseases and 3 to dysentery. At Sipri the average strength was 43, and there was only one death. At Umballa the average strength was 521, and the number of deaths 11, out of which 5 were due to phthisis, and 2 each to fever, dysentery, and respiratory diseases.

Twelve regiments of the regular army of Bengal suffered a mortality exceeding 20 per 1,000; of these 5 were serving in the Punjab, 2 in Egypt, 2 in Southern Afghanistan and Beluchistan, 2 in Meerut and Rohilkund, and 1 in Agra and Central India. The 26th Bengal Infantry at Meerut recorded a mortality of 27·26 per 1,000. This regiment arrived from Peshawar in February 1885. There were 22 deaths, 15 among men present with the regiment, and 7 among men absent. Of the 15 deaths, 7 were due to pneumonia and pleurisy, and 4 to fevers. The other regiment of the Meerut and Rohilkund group was the 22nd Bengal Infantry at Delhi, which suffered a mortality of 20·68 per 1,000. Of 13 deaths which occurred among men present with the regiment, 4 were due to fevers, and 4 to pneumonia and pleurisy. The 45th Bengal Infantry at Agra recorded the highest death-rate of regiments not on service,—namely 36·90 per 1,000. Of the 31 deaths which this ratio implies, only 11 occurred among men present with the regiment, 4 from fever, 3 from pneumonia and pleurisy, 2 from bowel disease, 1 from cholera. The regiment arrived from Jhelum in December 1884. Of the regiments in the Punjab, the 9th Bengal Cavalry recorded a ratio of 25·60 per 1,000. It only arrived at Umballa from Suakim in July 1885, and of the 15 deaths among those present with their regiment, 14 occurred at Suakim, and 13 of these resulted from injuries in action. The ratio of the 14th Bengal Cavalry at Meean Meer was 24·96, due to 14 deaths, 12 at head-quarters and 2 elsewhere; of the 12, pneumonia and pleurisy caused 7. The 1st Bengal Infantry at Rawal Pindi and Attock had a mortality of 23·20 per 1,000, due to 14 deaths among those present, and to 5 among those absent. Of the 14, 9 were due to pneumonia and pleurisy, and 2 to fevers. At Mooltan the death-rate of the 25th Bengal Infantry was 23·00 per 1,000, equivalent to 19 deaths. Of the 14 deaths which occurred among men present with the regiment, 8 were due to pneumonia and pleurisy. The mortality in the 24th Bengal Infantry at Meean Meer was 20·43 per 1,000, 11 deaths out of a total of 17 occurring among those present; of these, 6 were from fevers and 5 from pneumonia and pleurisy. In Southern Afghanistan the 5th Bengal Cavalry lost 27 men (25 present and 2 absent), or 50·09 per 1,000 of strength. It arrived at Thal Chotiali from Bareilly in January 1885. Of the 25 men who died with the regiment, 10 succumbed to scurvy, 6 to dysentery and diarrhœa, 3 to anæmia, and 4 to sunstroke. The 32nd Bengal Infantry arrived in the Harnai Pass (Beluchistan) from Umballa in November 1884. In 1885 it had a death-rate of 44·03 per 1,000, due to 32 deaths among those present and 3 among those absent, the chief causes of death being pneumonia and pleurisy (12), fevers (5), dysentery and diarrhœa (5), phthisis (3), and injuries (3). The 15th Bengal Infantry was in Egypt (Suakim) during the greater part of the year, leaving a depôt at Lucknow, but arrived at Nowshera in November 1885. Its death-rate was 35·93 per 1,000 due to 34 deaths among those present and 1 among those absent. Of the 34 deaths, 12 were from injuries (10 in action), 7 from scurvy, 4 from dysentery and diarrhœa, 3 each from fevers and pneumonia with pleurisy, and 2 each from anæmia and phthisis. The 17th Bengal Infantry was at Suakim until December 1885, when it arrived at Benares. It lost 21 men by injuries received in action, 8 from dysentery and diarrhœa, and 2 from fevers. There were in all 38 deaths (33 present and 5 absent), giving a ratio of 46·12 per 1,000 of strength.

Judged by the admission and daily sick-rates (1,152 and 35 per 1,000) the health of the Punjab Frontier Field Force was favourable. The death-rate (12·67, or, including absent deaths, 14·50), though higher than that of 1884, was lower than that of any other year except 1877. As compared with the previous year there was a reduction of no less than 174·5 per 1,000 in the ratio of admissions for intermittent fever, and of nearly 10 per 1,000 in the ratio of admissions for dysentery; but 10 of the 20 separate heads of disease showed an increase, including the serious increase of over 25 per 1,000 in the case of respiratory diseases. The ratio of admissions for respiratory disease in 1885 was 97·9 against 72·5 in 1884 and 109·4 in 1883, the average of 1867–76 being 66·0. The actual number of deaths from respiratory diseases was 67, equivalent to 6·34 per 1,000, against 54 or 5·16 in 1884. The per-centage of

deaths to cases treated was 6·47 against 7·12 in 1884. The largest ratio of admissions from all causes was 1,547 at Dera Ismail Khan, and the lowest 702 at Abbottabad. The highest mortality ratio was 17·99 at Dera Ismail Khan, and the lowest 4·83 at Murdan. Of individual regiments in this force the 2nd Punjab Infantry at Kohat suffered the largest mortality, namely, 29·06 per 1,000. This represents 24 deaths, 9 of which among those present at head-quarters were due to pneumonia and 8 to cerebro-spinal fever. The 1st Punjab Infantry at Dera Ismail Khan also had a high death-ratio, viz., 27·91, representing 23 deaths. Next came the 5th Punjab Infantry at Edwardesabad with 20 deaths, and the 3rd Sikh Infantry at Kohat with 17 deaths.

The health of the Central India Irregular Force was less favourable than in the previous year. The admission and death-rates (700 and 10·17 per 1,000) were both higher than they have been since 1881; the death-rate in 1884 was only 5·90 per 1,000. The ratios of admission from cholera, fevers, bowel diseases, and respiratory diseases were all higher; and there was a marked rise in the mortality from cholera, fevers, and respiratory diseases. Judging from the admission-ratios in the several stations occupied by these regiments, Erinpoorah was the most unhealthy, with an admission-rate of 1,088, being the only station with a ratio over 900 per 1,000. Goonah, with a ratio of 413 per 1,000, was the most healthy. Erinpoorah also showed the highest death-rate (22·76) and Ajmere and Beaur the lowest (4·81). The maximum and minimum of the previous year were 10·36 and 1·62. The Erinpoorah Battalion at Erinpoorah recorded 18 deaths among men present with the regiment, including 10 from pneumonia. The Meywar Bheel Corps at Kherwara lost nine men, 7 present and 2 absent, and of the 7 present, 5 were from pneumonia.

The health of the troops of the Hyderabad Contingent is usually very good, and during 1885 the vital statistics of the force maintained their favourable character. There were in all 41 deaths, or 5·88 per 1,000, 7 of which were due to cholera. The admission-rate was highest at Ellichpur (1,043) and Akola (828) and lowest at Raichore (278). The detachment of the 2nd Infantry at Hingoli lost 4 men from cholera and 1 from fever. The ratio for the regiment was 12·67 per 1,000 representing 10 deaths. The 5th Infantry, at Ellichpur, recorded a mortality-ratio of 10·92 per 1,000, representing 6 deaths among those present and 3 amongst those absent. The highest ratio was that of the 3rd Field Battery, representing however only two deaths.

Madras Army.

The health of the Madras troops not on active service in Burma was very favourable. The admission, daily sick, and death-rates are the lowest recorded in the following table. The mortality ratio from cholera was also below that of any previous year except 1880. There were 71 cases of cholera against 80 in the previous year. Of the 71 patients, 35 died, or a per-centage of 49·30; the per-centage in 1884 having been 51·25. Small-pox gave rise to 22 admissions, but fortunately without mortality. In 1884 there had been 100 cases with 6 deaths. There were 33 cases of hepatitis, of which 2 ended fatally, against 39 and 5 in the previous year.

Sickness and Mortality during the last Nine Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	28,304	861	28	2·79	11·80	14·36
1878	28,728	841	29	2·23	12·25	15·49
1879	27,314	1,269	43	3·19	18·89	21·23
1880	28,710	1,399	54	0·10	15·57	19·54
1881	28,533	997	41	1·37	12·02	16·75
1882	27,654	879	30	2·46	12·01	14·99
1883	27,703	737	27	2·92	10·76	12·51
1884	28,050	836	31	1·46	10·02	11·82
1885*	27,043	675	25	1·29	9·69	13·96

* Excluding men on active service in Burma and Egypt.

Of the large stations in the Madras Presidency with an average strength exceeding 1,000 men, Secunderabad recorded the highest admission-ratio, namely, 1,096 per

1,000, and next to it Kamptee (608), Bangalore (571), and Bellary (497); while of the stations with a strength between 500 and 1,000, Rangoon recorded 1,315, Vizianagram 1,037, Jubbulpore 855, and Toungoo 784. The highest mortalities took place in Southern Afghanistan (41·34), at Toungoo (17·49), Vellore (14·39), Jubbulpore (11·83), and Secunderabad (11·03). At Secunderabad, where the largest Native force was quartered, there were 38 deaths, of which 11 were due to fevers, 7 to respiratory disease, and 5 to cholera. In Southern Afghanistan, of 32 deaths 16 were from bowel disease, and 11 from respiratory disease. At Vellore, 4 of the 10 deaths were from cholera and 2 from phthisis. Six of the 12 deaths at Toungoo were due to bowel diseases; while at Jubbulpore 5 of the 8 were due to respiratory diseases. Of individual regiments and bodies the Sappers and Miners at Bangalore, with detachments at Sitabaldi, Aden, and Suakim, suffered the heaviest mortality in proportion to their number, namely 60·67. There were 55 deaths among those present with the regiment, and 3 amongst the absent. Of the 55 deaths, 26 occurred at Suakim and 14 in Burma. To injuries were due 13 deaths, to cholera 10, to dropsy 8, to pneumonia and pleurisy 5, and to fevers and heart disease 2 each. The 4th Madras Infantry in Southern Afghanistan, which it reached from Bangalore in November 1884, had a death-rate of 40·84, equivalent to 31 deaths among those present, and 2 among those absent. The deaths among those present were due to dysentery and diarrhœa in 16 cases, to respiratory diseases in 10 cases, and to fevers in 4 cases. At Toungoo the 3rd Madras Infantry suffered a mortality of 39·11, equivalent to 21 among those present, and 9 among those absent. Of the 21 deaths among those present, 8 were caused by cholera, and 6 by dysentery and diarrhœa. The death-rate of the head-quarters of the 29 Madras Infantry at Berhampore was 26·32, there having been 9 deaths among those present, and 3 among those absent. Of the deaths among those present, 3 were from dropsy, and 2 from injuries. The 26th Madras Infantry at Thayetmyo (where it arrived in January 1885 from Madras) recorded 7 deaths from debility, 2 from fevers, and 1 from cholera. The total number of deaths was 15 (13 present), giving a ratio of 18·18 per 1,000 of strength.

Bombay Army.

The health of the Bombay Army was unfavourable in comparison with recent years. The admission and daily sick rates were higher than they have been since 1880; while the death-rates from all causes and from cholera were higher than in any of the years noted in the following table:—

Sickness and Mortality during the last Nine Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	23,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·36	15·12	17·95
1879	22,854	1,663	51	3·11	20·22	21·90
1880*	15,328	1,283	45	—	10·44	56·53‡
1881*	18,349	1,166	41	1·85	14·01	25·93‡
1882†	23,772	1,067	36	0·46	12·16	13·41
1883	23,576	994	35	0·47	12·81	14·96
1884	23,373	1,153	38	0·39	12·96	14·35
1885§	22,701	1,243	43	5·42	24·84	26·01

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.
§ Excluding men on active service in Burma and Egypt.

As compared with the previous year the admission-rates from 12 of the 20 chief causes of disease were higher, the increase being most marked in the case of cholera, diarrhœa, respiratory diseases, eye-diseases, abscess and ulcer. Of 16 causes of mortality, there was an increase in 12, but especially in cholera, fevers, diarrhœa, respiratory diseases, and scurvy. Cholera caused 123 deaths against 9 in 1884, fevers 83 against 42, diarrhœa 32 against 14, respiratory diseases 169 against 105, and scurvy 12 against 4.

Sickness was most prevalent and fatal in the stations occupied in Southern Afghanistan and on the Persian Gulf. The admission-ratios for cholera, diarrhœa, and respiratory diseases were far higher in Southern Afghanistan than elsewhere, as

also the ratios of deaths from cholera, fevers, diarrhœa, and respiratory diseases. With regard to admissions, Aden and Sind came next to Southern Afghanistan in cholera and diarrhœa, and Khandeish and the Deccan in respiratory disease; while with regard to mortality, the Konkan came next to Southern Afghanistan in cholera and fevers, Khandeish and the Deccan in diarrhœa, and Aden and Sind in respiratory diseases. Scurvy was most prevalent in Southern Afghanistan, and in Aden with Sind. The Northern Division was the most healthy part of the Presidency. In the Bolan Pass and in the Peshin Valley the admission-rates were 3,762 and 3,418 per 1,000 respectively. These high ratios were mainly contributed to by fevers, bowel-diseases, and respiratory diseases, and especially in the case of the Bolan, also by cholera and rheumatism. Of the larger stations with over 1,000 men the most unhealthy were Quetta (admission-rate 2,734 per 1,000) and Poona (1,052), the most healthy, Bombay (528). Of the stations with between 500 and 1,000 men 8 had admission-ratios of over 1,000 per 1,000, the first 4 being Peshin Valley (3,418), Dhuki and Thal Chotiali (2,570), Rajkot (1,369), and Baroda (1,321). Nine stations had over 20 per 1,000 of mortality. The first five are in Southern Afghanistan, beginning with the Bolan (191·14) and ending with Sibi (63·06). Then follow the Persian Gulf (35·09), Malegaon (31·82), Surat (24·88), and Kurrachee (24·32). The Persian Gulf Stations had 6 deaths, all from different diseases; Malegaon 7, of which 2 were from cholera; Surat 5, of which 3 were from cholera; and Kurrachee 18, of which 8 were due to respiratory diseases, 2 to dysentery, and 1 to cholera. Twelve regiments had a mortality of over 20 per 1,000, of which 6 were in South Afghanistan, where there was no lower ratio than 56·12 per 1,000. The two highest ratios were 154·81 in the 14th Bombay Infantry at Peshin and outposts, and 107·87 in the 20th Bombay Infantry at Dhuki and outposts. The former regiment had 120 deaths among those present and 4 among those absent, the chief causes in order being fevers, bowel diseases, cholera, respiratory diseases, anæmia; the latter recorded 79 deaths among the present and 6 among the absent, caused chiefly by cholera (40) and respiratory diseases (17). The 5th and 6th Bombay Cavalry and the 27th Bombay Infantry, all at Jacobabad and outposts, had all ratios over 20 per 1,000, the chief cause being respiratory disease in the two cavalry regiments and cholera in the infantry. The 2nd Bombay Infantry at Ahmedabad, which arrived there in March from Quetta, had a ratio of 42·09. Out of the 30 deaths among those present, 25 occurred at Quetta or on the march. No. 1 Mountain Battery had a ratio of 24·51 from 4 deaths among those present and 1 among those absent. Two of the deaths occurred in Burma. The Sappers and Miners had 10 deaths, all among those present, principally from bowel diseases, cholera, and fevers, giving a ratio of 20·70 per 1,000 of strength.

Having considered individually the health statistics of the several portions of the Native Army of India in the foregoing paragraphs, it will now be convenient to contrast the main features of each, and, for convenience, the chief results are brought together in the following table:—

Presidency.	Total Deaths per 1,000 including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army	14·18	40,753	1,076	34	·29	10·11
Madras „ „	13·96	27,043	675	25	1·29	9·69
Bombay „ „	26·01	22,701	1,243	43	5·42	24·84
Central India Regiments	11·54	5,112	700	19	1·76	10·17
Punjab Frontier Force	14·50	10,576	1,152	35	—	12·67
Hyderabad Contingent	7·57	6,969	522	17	1·00	5·88
India	16·09	115,486	978	32	1·61	13·67

The Hyderabad Contingent and the Madras Army show the most favourable results both with regard to admissions and deaths, the Central India regiments not being far behind. The highest admission, daily sick, and death-rates were recorded in the Bombay Army and Punjab Frontier Force; and the death-rate from cholera is much higher in the Bombay Army than in any of the other bodies.

Jails.

Sickness and mortality in 1885.

The progressive annual decline in the average number of prisoners confined in the jails throughout India having still continued, the year 1885 shows a smaller average

strength than 1884. Sickness, estimated by the admission and daily sick-rates, was less than in any year since 1881 except 1883. But along with this the death-rate rose from 29·11 in 1884 to 33·54 per 1,000, which is, however, lower than that of any year preceding 1883. The increase of mortality took place solely in the Bengal Presidency, and especially in the Central Provinces and Bengal Proper. The greater part of the increased mortality was due to cholera and bowel diseases. The rise in the death-rate from bowel complaints is to be regretted, although it still remains lower than in any previous year except 1883 and 1884. The admission-rate from bowel diseases also increased, having been 190·2 per 1,000 against 175·2 per 1,000 in 1884; and it should be noted that the ratio of 1884 was greater than that (164·5) of 1883. The death-rate from anæmia and debility also increased, though to a less degree, and the rates from fevers, scurvy, phthisis, apoplexy, hepatitis, injuries, &c., to a still slighter extent; while those from small-pox, respiratory diseases, and spleen diseases diminished; and that from heart diseases remained the same as in 1884.

Statement showing the Strength, Sickness, and Mortality among the Prisoners of India during the years 1872–76, 1877–81, *and* 1881 *to* 1885.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1872–76	99,758	1,016	?	2·86	13·48	36·24
1877–81	112,670	1,189	44·9	4·48	24·97	63·01
1881	100,844	1,214	45	3·03	16·92	44·03
1882	94,063	1,214	42	2·75	15·21	39·96
1883	88,174	996	36	2·28	10·64	31·37
1884	85,496	1,025	37	1·43	9·73	29·11
1885	82,650	1,014	36	3·44	11·18	33·54

In 1885 the average number was less than the approximate average number during the 10 years 1872–81 by 23,564. The proportion of prisoners to the general population was 4·2 per 10,000 against 4·3 in 1884 and 4·5 in 1883. For the several Presidencies, the ratios are given in the following table:—

Ratio of Prisoners per 10,000 *of Population in each of the three Presidencies for* 1885, 1884, 1883, 1882, 1881, *and* 1872–76 *compared.*

Presidency.	Period.	General Population, according to Census of 1881.	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal	1872–76	147,215,384	68,328	4·6	39·39
	1881		63,478	4·3	44·42
	1882		59,489	4·0	42·56
	1883		54,982	3·7	34·28
	1884		51,877	3·5	32·71
	1885		49,404	3·4	38·40
Madras	1872–76	31,170,631	9,607	3·1	32·37
	1881		10,332	3·3	41·91
	1882		8,752	2·8	42·62
	1883		7,666	2·5	29·87
	1884		6,959	2·2	20·55
	1885		6,942	2·2	17·86
Bombay	1872–76	16,454,414	8,011	4·9	26·61
	1881		9,910	6·0	41·88
	1882		8,845	5·4	33·35
	1883		7,806	4·7	34·33
	1884		7,305	4·4	34·91
	1885		6,872	4·2	33·76

Both sickness and mortality were greater in the jails of the Bengal Presidency than in those of the other two Presidencies.

Sickness and Mortality among Prisoners in the three Presidencies during 1885 *compared.*

Presidency.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
Bengal - -	49,404	1,060	36	4·07	14·68	38·40
Madras - -	6,942	705	25	·43	3·89	17·86
Bombay - - -	6,872	645	25	2·62	5·68	33·76

Compared with 1884 Bengal shows a considerable increase in total mortality, in deaths from bowel diseases, and in admission and daily sick rates. Both Bengal and Bombay show a decided increase in cholera mortality. The Madras statistics are very satisfactory, showing a great reduction both in sickness and mortality with much reduced death-rates from cholera, bowel diseases, and several of the other causes of mortality enumerated in the table.

Year.	Average Strength of Bengal Jails.	Ratio per 1,000.				
		Admissions.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1877–81 -	69,149	1,145	40	3·90	22·32	55·40
1877 -	63,600	967	30	3·07	10·59	31·88
1878 -	78,116	1,182	41	5·34	28·27	65·85
1879 -	73,801	1,285	46	6·38	30·65	77·90
1880 -	66,751	1,108	40	1·00	21·51	51·12
1881 -	63,478	1,151	41	3·10	17·91	44·42
1882 -	59,489	1,178	40	3·11	17·31	42·56
1883 -	54,982	949	32	2·35	12·93	34·28
1884 -	51,877	1,028	34	1·52	12·66	32·71
1885 -	49,404	1,060	36	4·07	14·68	38·40

Sickness and mortality in the Bengal Presidency were greater than in 1884, 1883, and 1877, but less than in the years between 1877 and 1883. The same comparison applies also to the death-rate from bowel diseases. The increase in the death-rate from bowel diseases over 1884 amounts to 2·02 per 1,000, of which 1·86 is due to dysentery and 0·16 to diarrhœa.

Fevers were less prevalent than during the preceding year, but were attended by a somewhat increased mortality. Both admissions and mortality were below the decennial averages of 1873–1882. With the exception of fevers, venereal diseases, and rheumatism, all the chief diseases as given in the following table were more prevalent in 1885 than in 1884. The admissions for dysentery, diarrhœa, and atrophy and anæmia were considerably, and those for wounds and accidents and eye-diseases slightly, above the decennial averages of 1873–1882.

Number.	Diseases.	Decennial Average, 1873–82.	Admitted per 1,000 of Average Strength.												
			1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers - -	488	441	452	389	541	528	458	660	556	371	457	398	445	450
2	Abscess and ulcer -	116	100	94	102	123	127	133	114	113	122	115	99	107	110
3	Dysentery - -	112	137	117	100	117	105	116	129	137	98	104	96	101	110
4	Diarrhœa - -	103	111	106	100	108	106	117	112	107	94	86	90	96	108
5	Respiratory diseases -	44	40	36	39	45	48	48	21	45	43	41	37	45	44
6	Wounds and accidents -	41	42	35	36	39	40	37	36	43	48	39	43	44	43
7	Atrophy and anæmia -	23	34	28	27	28	28	28	29	28	24	19	16	15	19
8	Venereal diseases -	17	17	18	18	21	20	20	18	18	15	12	21	16	12
9	Rheumatism - -	17	16	16	16	16	15	15	15	16	21	17	16	19	17
10	Eye diseases - -	13	14	13	13	15	13	14	11	13	12	11	11	12	13
	Total of the Ten -	973	952	915	840	1,053	1,030	986	1,166	1,076	848	901	827	900	927
	Total from all Causes	1,091	1,060	1,028	949	1,178	1,151	1,108	1,285	1,182	967	1,017	943	1,028	1,043

With regard to mortality cholera, dropsy, and wounds and accidents only were above the decennial averages; but all the chief diseases in the following table, except respiratory diseases, dropsy, and spleen diseases, caused more deaths than in 1884.

Number.	Diseases.	Decennial Average, 1873–82.	Died per 1,000 of Average Strength.											
			1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	18·90	14·68	12·66	12·93	17·31	17·91	21·51	30·65	28·27	10·59	14·75	12·38	16·38	16·63
2	Respiratory diseases -	7·18	5·83	6·03	6·00	7·26	7·62	9·38	9·53	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers - - -	5·29	2·49	2·16	2·38	3·53	4·65	4·45	13·82	7·14	1·97	2·36	4·20	3·72	5·47
4	Cholera - - -	3·46	4·07	1·52	2·35	3·11	9·10	1·00	6·33	5·34	3·07	4·24	2·35	2·48	2·97
5	Atrophy and anæmia -	3·10	2·49	2·10	2·02	3·64	2·58	3·66	5·43	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis -	2·50	2·41	2·12	2·31	1·98	2·24	2·53	3·00	2·76	2·36	3·24	1·86	2·51	2·33
7	Dropsy - -	·80	·85	0·85	0·80	0·88	·68	1·05	0·99	0·83	0·71	0·73	0·67	0·85	0·55
8	Wounds and accidents	·68	·69	0·46	0·44	0·62	·55	·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
9	Apoplexy - -	·66	·63	0·52	0·60	0·30	·58	·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
10	Spleen diseases - -	·35	·20	0·27	·34	0·19	·22	·57	0·31	0·23	0·20	0·29	0·77	0·37	0·23
	Total of the Ten	42·91	34.34	28·69	30·17	38·22	40·13	45·66	71·53	60·63	28·55	34·36	30·03	35·70	38·76
	Total from all Causes	47·36	38·40	32·71	34·28	42·56	44·42	51·12	77·90	65·85	31·88	37·51	33·65	39·90	43·08

It is satisfactory to observe that mortality from respiratory diseases diminished in 1885 as compared with 1884, although the diseases were more prevalent. Among fevers, 18 cases of enteric with 4 deaths (22·22 per cent.), and six fatal cases of cerebro-spinal fever, were returned.

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged in Groups in accordance with their Geographical Positions) from 1877–81, 1882, 1883, 1884, *and* 1885.

Groups.		Average Strength.	Ratio per 1,000.					Difference between Average Mortality and Year's Mortality.
			Admissions into Hospital.	Daily Sick.	Deaths from			
					Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam - -	1877–81	14,788	1,519	50	7·43	31·63	67·50	
	1882	13,327	1,693	54	8·25	25·44	59·95	
	1883	12,414	1,630	53	4·03	22·64	52·52	—7·00
	1884	12,250	1,586	55	4·24	25·06	57·71	
	1885	12,148	1,642	58	7·24	28·73	60·50	
II.—Gangetic Provinces and Oudh -	1877–81	22,769	695	25	3·21	13·98	33·29	
	1882	13,515	724	28	3·19	14·36	33·70	
	1883	16,840	616	23	3·32	8·67	25·76	— 5·66
	1884	15,822	629	24	0·88	8·91	21·05	
	1885	15,347	678	25	5·08	8·93	27·63	
III.—Central Provinces (excluding Jubbulpore and Saugor) -	1877–81	3,002	983	36	11·39	26·11	69·88	
	1882	2,833	1,106	48	4·24	49·42	89·66	
	1883	2,609	1,003	41	4·22	60·56	88·54	— 1·17
	1884	2,259	902	34	0·44	22·13	45·15	
	1885	2,285	983	38	15·32	29·76	68·71	
IV.—Agra and Central India - -	1877–81	5,338	1,063	49	2·89	17·16	51·33	
	1882	4,513	763	28	0·89	6·65	27·92	
	1883	4,359	556	21	2·75	6·19	21·56	—13·26
	1884	4,224	640	24	0·24	7·34	19·89	
	1885	3,835	779	33	—	17·47	38·07	
V.—Rohilkund and Meerut - -	1877–81	9,072	935	40	0·35	15·30	37·59	
	1882	7,187	1,007	38	—	7·65	25·46	
	1883	6,627	753	31	—	3·62	18·26	— 9·21
	1884	6,054	1,074	34	1·82	7·93	25·60	
	1885	5,321	1,209	41	—	10·34	28·38	
VI.—Punjab - -	1877–81	14,180	1,674	51	2·38	31·64	88·13	
	1882	13,115	1,546	45	—	15·25	41·63	
	1883	12,128	951	27	—	6·18	29·11	—61·00
	1884	11,268	1,131	27	—	7·10	28·04	
	1885	10,468	1,000	25	—	4·68	27·13	

As in the preceding year, the Gangetic Provinces and Oudh group was the most healthy, with an admission-rate of 678 and a daily sick-rate of 25 per 1,000; while the Bengal and Assam group was the most unhealthy, with an admission-rate of 1,642 and a daily sick-rate of 58 per 1,000. The Rohilkund and Meerut group was next to

the Bengal and Assam group in unhealthiness, and the Agra and Central India group ranked second to the Gangetic Provinces and Oudh group in healthiness. The character of the sickness in the Punjab appears to have been in striking contrast with that in the Central Provinces. The former had an admission-rate of 1,000, a daily sick-rate of 25, and a death-rate of 27·13; while the latter had an admission-rate of 983, a daily sick-rate of 38, and a death-rate of 74·33 per 1,000. The former had slightly more sickness than the latter; but the sickness in the latter was of a much more severe and fatal type. A comparison of the last column of the preceding table with the corresponding one in the table for 1884 shews that, with the exception of the sixth group, which improved its already favourable position, all the remaining groups exhibited less favourable diminutions over quinquennial averages. This is most marked in the case of groups III. and IV. Cholera was very fatal in 1885 as compared with 1884 in groups III., I., and II, in this order; but caused no deaths in groups IV., V., and VI. The mortality from bowel disease was greater than in 1884 in all the groups, except in the sixth where it was remarkably low, and in the second where it was practically unchanged. It exceeded the quinquennial average only in the case of the third and fourth groups.

The health of the prisoners in Lower Bengal was less favourable than in 1884. The admission-rate rose from 1,420 to 1,485, and the daily sick rate from 50 to 52 per 1,000; both being higher than the ratios of the five-year period 1877-81. The death-rate from all causes increased by no less than 9·34 per 1,000, though it still remained below the quinquennial average. Cholera caused 10·42 per 1,000 of the total mortality—a proportion that has only twice been exceeded since 1877, namely, in 1878 and 1879.

Of the years noted in the following table it will be seen that the highest admission-rate for bowel diseases occurred in the year under report; while the death-rate from the same causes, though not by any means the highest, is higher than that of the preceding year by 4·26, and than that of 1883 by 3·65 per 1,000. The admission-rate for fever also was greater than in 1884, but less than in 1883, but the mortality was considerably higher than in either of those years. There was, therefore, on the whole in Lower Bengal an increase of sickness with a disproportionately great increase of mortality.

Year.	Ratio per 1,000.			
	Fevers.		Bowel Complaints.	
	Admissions.	Deaths.	Admissions.	Deaths.
1876*	483	2·67	356	17·68
1877	457	3·09	399	19·24
1878	472	3·22	404	31·60
1879	565	2·53	470	45·92
1880	574	4·65	467	33·02
1881	624	4·16	445	33·48
1882	598	5·74	505	32·16
1883	546	3·15	477	23·44
1884	473	2·24	497	22·83
1885	504	4·03	537	27·09

* Assam included.

Of the eight jails containing on an average over 500 prisoners, the highest admission-rates prevailed in the following:—Rajshahai 1,941, Alipore 1,894, Dacca 1,893, Midnapore 1,263, Presidency (natives) 1,239, Hazaribagh 1,201, Buxar 871, and Bhagalpur 677. Of these jails, four show an admission-rate for fevers of over 500 per 1,000, viz., in order Rajshahai, Alipore, Buxar, and Presidency (natives); remittent and continued fevers being most prevalent in the Dacca, Alipore, and Presidency (natives) Jails. Among these eight jails, we find that, by far the highest mortality occurred in the Hazaribagh (178 per 1,000), and the Rajshahai (164) jails, exceeding greatly the ratios of the preceding year. Excluding cholera, the Rajshahai Jail would represent the highest mortality (142), followed by the Hazaribagh Jail (83), and the Dacca Jail (50). The lowest mortality was recorded in the Buxar Jail 13·70, which includes no cholera deaths. The largest number of cases of cholera in the eight jails occurred in the Alipore Jail (90), the Hazaribagh Jail (76), and the Rajshahai Jail (20). Among these eight jails, the highest admission-rates for bowel diseases

were recorded at Dacca (992 per 1,000), Rajshahai (778), and Alipore (538), the lowest rate was that of the Baxar Jail (70). The greatest number of deaths from bowel diseases occurred in the Rajshahai (80), Alipore and Hazaribagh (29 each), and Dacca (23) jails, the lowest (4) in the Buxar Jail. Sixteen deaths occurred in the Dacca Jail from respiratory diseases, which is twice as many as occurred in any other jail of the province. Taking the smaller jails, with less than 500 average strength, we find one jail, Khoolna, with an admission-rate from all causes of over 4,900 per 1,000, and a daily sick-rate of 91, but its strength was only 77. Next we have nine jails, with a rate of over 2,000; one of them (Mymensingh) with a strength of over 300, three of over 200, two of over 100, and three of under 100. With an admission-rate of over 1,000, there were 18 jails of an average strength varying from 84 to 274; whilst with an admission-rate of under 1,000, there were only nine jails. Excluding the Balasore Jail, which had a strength of only 82, the most healthy jails were the Durbhunga Jail, with an average strength of 250, an admission-rate of 400, and a daily sick-rate of 16 per 1,000; and the Patna Jail, with an average strength of 262, an admission-rate of 462, and a daily sick-rate of 11·5 per 1,000. Of the 45 jails in Bengal Proper sickness and mortality increased in 27, and diminished in 18, as compared with the previous year. The highest mortality occurred in the Hazaribagh Jail (178·20 per 1,000, including 95·16 from cholera) due mainly to cholera and bowel diseases; in the Jalpaiguri and Dinagepore Jails due chiefly to bowel disease, and in the Rajshahai Jail due mostly to bowel diseases, cholera, fevers, and phthisis. The smallest mortality occurred in the Buxar (13·70) and Bhagalpur Central (19·21) jails, excluding those with very low average strengths, and in which there were no deaths. Of the total mortality a proportion of over 20 per 1,000 was due to cholera in the case of Hazaribagh (natives), Chumparun, Rajshahai, Maldah, Moorshedabad, and Alipore. The greatest number of cases of cholera occurred in Alipore (90), Hazaribagh (76), Chumparun (26), and Rajshahai (20). Of the total admission-rate a proportion of over 700 per 1,000 was from bowel diseases in the Khoolna, Maldah, Purneah, Jalpaiguri, Rungpore, Rajshahai, Pubna, Furreedpore, Bogra, Mymensingh, Chittagong, Tipperah, Dacca, Pooree, Chybassa, and Chumparun Jails. The highest proportion of continued and remittent fevers in the total admission-rates occurred in order in Mozufferpore, Jessore, Dacca, Furreedpore, and Pooree. The greatest number of deaths from fevers occurred in the Alipore, Presidency, and Rajshahai Jails; from bowel diseases in the Rajshahai, Alipore, Hazaribagh, Mymensingh, and Dacca Jails; from respiratory diseases in the Dacca, Alipore, Rungpore, Rajshahai, and Buxar Jails; from phthisis in the Presidency, Rajshahai and Rungpore Jails. In the Tipperah and Bankoora Jails there were no deaths. The Dacca Jail had four deaths from small-pox. No less than 14 jails recorded the presence of scurvy.

In the North-Western Provinces, the admission-rate (743 per 1,000) rose to a higher point than it had reached since 1881; and the daily sick and death-rates (28 and 21·64) were higher than in either 1884 or 1883. It is very satisfactory to find that the death-rates from cholera, small-pox, fevers, bowel diseases, respiratory diseases, &c., were all less than in 1884; and that the slight increase of the total death-rate was spread over the following five diseases (in order) anæmia and debility, phthisis, apoplexy, hepatitis, and heart diseases. There were no deaths from small-pox. The cholera death-rate (0·46) was less than it had been since 1881 and also less than the average of 1877–1881. A comparatively low rate of death from bowel disease has been maintained since 1880. The diseases causing the largest number of admissions were, in order, fevers, abscess and ulcer, bowel diseases, injuries, respiratory diseases, anæmia and debility, venereal diseases, eye diseases, and rheumatic affections.

There were six jails with an average strength of over 1,000—Benares, Lucknow, Fatehgarh, Allahabad, Agra, and Bareilly Central Prisons. (The Meerut Central Jail has been kept at a low strength on account of its unhealthiness, and is about to be abandoned.) The highest admission-rate among these jails was 758 per 1,000 in Agra and the lowest 237 in Lucknow. The highest death-rate was 24·48 per 1,000 in Allahabad and the lowest 14·25 in Bareilly. In all, except Fatehgarh, the rate of admission for fevers was greater than in the previous year, and in all, except Bareilly, the admission-rate for bowel diseases was also greater. The highest admission and death-rates from bowel diseases occurred in Bareilly, and the smallest admission-rate in Lucknow, and the smallest death-rate in Fatehgarh. Cholera occurred only in Benares and Fatehgarh, causing 5 deaths in the former and 1 in the latter. Respiratory diseases caused 12 deaths in Benares and 6 in Agra, and from 1 to 5 in the other jails. Eight deaths occurred from phthisis in the Agra Central Prison, and from 1

to 5 in the others. Allahabad had 9 deaths from anæmia and debility, Lucknow 8, and the other jails from 1 to 4. Of the jails with an average strength of under 500, Etah (166 prisoners), Muzaffarnagar (167), Meerut Central (441) recorded admission-rates of over 2,000; Hamirpur, Orai, Fatehpur, Banda, Muttra, Mainpuri, Shahjahanpur, Budaon, Saharanpur, Dehra Dun, Moradabad, and Meerut District, of over 1,000; while the remaining 31 jails had 1,000 or less. Of the 52 jails in the North-Western Provinces and Oudh, the most unhealthy would appear to have been the Etah, Muzaffarnagar, Meerut Central, Moradabad, Banda, Shahjahanpur, Saharanpur, Fatehpur, Orai, Budaon, and Muttra Jails. The most healthy jails would appear to have been the Allahabad, Lucknow, and Fatehgarh Central Jails, and the Partabgarh, Sultanpur, and Ghazipur District Jails. The maximum admission-rate (237 per 1,000) was recorded at Lucknow Central, and the minimum daily sick-rate (7·5) at Partabgarh. In 28 jails sickness was decidedly greater than in the previous year, while in 24 it was much less. The mortality increased in 29 jails and diminished in 22. The highest mortality rates occurred in the Meerut Central Jail (81·63) due principally to respiratory diseases, bowel diseases, fevers, and phthisis; in the Gorakhpur Jail (64·52) due chiefly to bowel diseases, cholera, anæmia, phthisis, and heart disease; and in the Moradabad Jail (58·67) due mainly to bowel disease, respiratory diseases, and anæmia. Cholera appeared in four jails, but proved fatal in three of them—in Benares Central 7 cases with 5 deaths; in Gorakhpur, 5 cases with 3 deaths; and in Fatehgarh Central 1 fatal case.

The health of the Punjab jails was better than in 1884; the admission-rate (1,000), the daily sick-rate (25), the total death-rate (27·13), and the death-rate from bowel diseases (4·68), being all below those of 1884, and except the first below those of 1883. As in the previous three years there was no cholera mortality. Respiratory diseases gave rise, as usual, to the largest proportion of deaths, 11·27 per 1,000, against 8·43 per 1,000 in 1884. In the period 1859–67, the average mortality from these diseases was only 2·81. It is satisfactory to observe that the death-rate from bowel diseases has continued low for three years, and that the last of the three years shows the lowest rate.

There are 34 jails in the Province. The Lahore Female Jail alone showed an admission-rate of over 2,000. Thirteen jails recorded rates exceeding 1,000. Of the two jails with a strength of over 1,000, the Lahore Central recorded an admission-rate of 1,519, and the Chináwán Jail 778 per 1,000. Three of the jails were so small that their statistics are here disregarded. Of the remaining 31 the statistics of most were more favourable than in the previous year, the most marked exceptions being the Lahore Female and the Delhi jails. In 15 of the 31 the mortality was greater, and in 15 it was less than in 1884. The highest mortality rates occurred in the Delhi Jail (82·69 per 1,000) due chiefly to respiratory diseases, bowel diseases, and phthisis; in the Amritsar Jail (59·52) due mostly to bowel diseases, fevers, and respiratory diseases; and in the Lahore Female Jail (57·14) due in the main to respiratory diseases and anæmia. Excluding the jails with strengths under 100, the highest admission-rates for continued and remittent fevers were recorded in Jullundur (40·4 per 1,000), in Kohat (38·5), and in Rawal Pindi (33·2); for respiratory diseases in Rohtak (150·7), Mooltan (130), Montgomery (122·5), and Delhi (118·9).

The admission and death-rates (983 and 74·33 per 1,000) recorded in the jails of the Central Provinces were higher in 1885 than in any year since 1878, and higher than the average of 1877–81. The death-rate from cholera (10·36) was much increased, but this was entirely due to an outbreak of the disease in one jail. The death-rate from bowel diseases (37·02) was also much higher than in 1884; and these were in fact the chief causes of sickness and mortality in most of the jails. The other chief causes of sickness were in (in order) fevers, abscess and ulcer, anæmia and debility, wounds and accidents, respiratory diseases, rheumatism and rheumatic affections, scurvy, venereal and cholera; and the other chief causes of mortality (in order) cholera, anæmia and debility, respiratory diseases and scurvy. Four of the jails returned admissions and two of them deaths from scurvy.

Of the 19 jails in this province, Raipur, Nagpur, and Jubbulpore have a strength of over 500, and 4 others have a strength of over 100. The Raipur Jail stands alone in having suffered from an outbreak of cholera—40 cases with 35 deaths. The Jubbulpore Jail recorded a fever admission-rate of 366 per 1,000 against 262 in Nagpur and 201 in Raipur; a bowel disease admission-rate of 503 against 386 in Nagpur and 140 in Raipur; and an anæmia admission-rate of 102 against 57 in Raipur, and 34 in Nagpur. For respiratory diseases Nagpur recorded an admission-rate of

45 against 31 in Raipur and 24 in Jubbulpore. Raipur recorded an admission-rate for scurvy of 84 per 1,000 against 19 in Nagpur and 4 in Jubbulpore. Of the jails containing over 100 and less than 200 prisoners Saugor was the most unhealthy; and its sickness and mortality were due in the first place to bowel diseases, and in the second to fevers. Taking all the jails together, we find that 10 or 11 suffered decidedly more from sickness than in the previous year, and 12 recorded a higher mortality. Several of the very small jails had no deaths. Of the 251 deaths in the jails of the province, 211 were contributed by the large jails—Raipur, Nagpur, and Jubbulpore, nearly one-half of them being from bowel diseases; and of the 40 contributed by the smaller jails, 21 were from bowel diseases. The Jubbulpore Jail recorded an admission-rate from bowel diseases of over 500, and six other jails of over 200 per 1,000.

The admission, daily sick, and death-rates in the Berar jails (549, 13, and 9·14 per 1,000 respectively), were all greater than in 1884, the last being higher than it has been since 1880. But it is satisfactory to find that there was not a single death from bowel diseases, and that the increase of the cholera death-rate from zero to 0·96 was due to a single death from that disease in the Amraoti Jail. The increase in the general admission-rate was due mainly to the increased prevalence of cholera, fevers, bowel diseases, spleen diseases, respiratory diseases, phthisis, and scurvy, and the increased mortality to cholera, fevers, respiratory diseases, heart diseases, phthisis, anæmia, &c.

The Amraoti Jail recorded an admission-rate of 586 per 1,000 against 457 in 1884, and a death-rate of 16·35 (including 2·72 from cholera against none in 1884). The Akola Jail recorded an admission-rate of 561 against 426 in 1884, and a death-rate of 21·19 against 20·27 in 1884. In 1884 Akola was the only one of the six jails of this province that recorded deaths, and they were 9 in number. In 1885, twenty deaths were distributed over four jails, 10 in Akola, 6 in Amraoti, 2 in Buldana, and 2 in Yeotmahl. Admissions from scurvy were recorded only in the Amraoti Jail.

In the Burma jails there occurred, with a diminishing admission-rate, an increase in the daily sick-rate and a marked increase in the total death-rate, as well as in the death-rates from cholera and from bowel diseases. The admission-rate (869), though less than in any year since 1879, was greater than the average of 1877–81. The cholera death-rate (8·92) was higher than it had been since 1878. The death-rate from bowel diseases (14·78) was higher than the average of 1877–81, and nearly twice as high as the rate of any year since 1881. The total death-rate (43·15) was nearly equal to the average of 1877–81 (43·67). The reduction in the admission-rate was due to smaller ratios returned under the heads of fevers, small-pox, respiratory diseases, dropsy, hepatitis, scurvy, and spleen diseases. The increase in the death-rate was due mainly to bowel diseases, cholera, anæmia, respiratory diseases, phthisis, and fevers. There were altogether 295 deaths against 201 in 1884.

Excluding the Sandoway and Mergui Jails, which are very small, and whose ratios therefore do not convey any clear representation of the facts, there are 12 jails in Burma whose statistics may be considered here. Of these 7 were decidedly less healthy in 1885 than in 1884. The decrease in the admission-rate for the province, as a whole above referred to, was chiefly due to a decrease of nearly 300 per 1,000 in the Rangoon Jail. Mortality increased in 8 and diminished in 4 jails as compared with 1884. The increase was chiefly due to cholera in the Bassein, Rangoon, and Toungoo Jails, to fevers in the Moulmein Jail, and to bowel diseases in the Akyab, Kyaukphyu, Rangoon, Bassein, and Moulmein Jails. Cholera occurred in the Bassein, Rangoon, and Toungoo Jails severely, and less so in the Kyaukphyu and Moulmein Jails. It caused altogether 61 deaths against 32 in 1884. Of these 32 occurred in Bassein, 13 in Rangoon, 12 in Toungoo, 2 in Kyaukphyu, and 2 in Moulmein. The Rangoon Jail recorded an admission-rate of 1,017 and a death-rate of 27·26 (including 4·73 from cholera). The chief diseases composing the admission-rate were fevers (227 per 1,000), bowel diseases (140), anæmia (43), respiratory diseases (7), cholera (7), phthisis (3), hepatitis (3). It recorded 75 deaths,—21 from anæmia, 15 from bowel diseases, 13 from cholera, 5 from fevers, 4 from hepatitis, 3 from respiratory diseases, and 3 from phthisis. The Moulmein Jail, the next largest in the province, recorded an admission-rate of 1,136 and a death-rate of 47·26 (including 1·52 cholera). The chief diseases making up the admission-rate were bowel diseases (272 per 1,000), fevers (130), anæmia (63), respiratory diseases (29), dropsy (15), phthisis (5), cholera (2), and spleen (2). It recorded 62 deaths, 34 from bowel diseases, 5 from phthisis, 5 from dropsy, 3 from anæmia, 3 from respiratory diseases, 3 from fevers, and 2 from cholera.

Bowel diseases, it will be seen, were much more prevalent and fatal in the Moulmein than in the Rangoon Jail. Taking the 8 jails of a strength exceeding 200, the highest admission-rates were at Moulmein, Kyaukphyu, and Rangoon. The highest mortality-rates were at Kyaukphyu (99·55) due to bowel diseases, cholera, anæmia; of Akyab (90·48) due to bowel diseases, anæmia, respiratory diseases; and of Bassein (81·60) due to cholera, bowel diseases, respiratory diseases. The Akyab, Moulmein, and Kyaukphyu Jails had each an admission-rate of over 200 per 1,000 for bowel diseases, while the rates for Henzada and Thayetmyo were under 40. The highest rate of admission for continued and remittent fevers occurred in the Rangoon Jail, and the lowest in the Thayetmyo Jail. The 7 deaths from small-pox, which occurred among the prisoners during the year were all in the Thayetmyo Jail.

All the ratios were higher in the Assam jails in 1885 than in 1884. It may be said that the sickness in the Assam jails has been gradually increasing since 1880. In 1883 a considerable rise in the admission-rate (from 2,109 per 1,000 in 1884 to 2,217) was accompanied by a great rise in the daily sick-rate (from 56 to 67). This simultaneous rise appears to point to the incidence of a severer type of sickness, and the death-rates from cholera (5·91), from bowel diseases (27·85), and from all causes (61·60) were greater than in 1884. The increased admission-rate was chiefly due to the greater prevalence of fevers, bowel diseases, phthisis, dropsy, anæmia, injuries; and the increased death-rate to cholera, bowel diseases, phthisis, dropsy, anæmia. Scurvy contributed 2·5 to the admission-rate and cholera contributed 5·91 to the death-rate.

Almost all jails recorded admission-rates exceeding 2,000 per 1,000. The highest ratio was recorded in the Shillong jail, namely, 2,723 per 1,000, but this is the smallest jail of the province, with an average strength of only 47 prisoners. At Sylhet, the largest jail, the admission-rate was 2,091 per 1,000. The highest death-rate was recorded at Gauhati, namely, 77·42 per 1,000. The mortality in the lock-ups was very high, namely, 115·65, due mainly to bowel diseases, cholera, and fevers. The mortality in the Gauhati jail was due mainly to bowel diseases and dropsy. The highest rate of admission from intermittent fever was in Gauhati, and the highest from remittent and continued in the lock-ups. The highest rate of admission for cholera was in the lock ups (68·0). Of the two jails attacked with cholera, the rates were 8·8 in Tezpur and 7·8 in Sylhet. Deaths from fevers occurred only in the lock-ups (3) and in Sylhet (2). The greatest number of deaths from bowel diseases occurred in Sylhet (14), lock-ups (6), and Tezpur (4). The total number of deaths in the Assam jails was 73, of which bowel diseases contributed 33, and no other disease more than 8.

The improvement in the health of the Madras prisoners noted in the Report for 1884 was more than maintained in 1885. All the ratios were less than in 1884. The ratios for cholera and for bowel diseases (0·43 and 3·89) were nearly one half what they were in 1884, which were themselves nearly one-half those of 1883. The death-rate from all causes was the lowest on record, namely, 17·86 per 1,000, a very satisfactory ratio absolutely as well as comparatively. The nearest approaches to this ratio were 17·9 in 1871 and 20·55 in 1884. With the exception of rheumatic and venereal affections, all the chief causes of admission contributed fewer numbers than in the previous year. Heart diseases, apoplexy, and small-pox were the only diseases that gave rise to a greater number of deaths than in 1884.

Of 27 jails (excluding 2 small jails whose statistics may be disregarded) 15 were decidedly healthier than in 1884, and 7 less healthy. 15 recorded fewer deaths and 11 more. Of the 5 jails with an average strength of over 500, only the Rajamundry Central Jail recorded an admission-rate of over 1,000 per 1,000. In 2 of the 5, the Trichinopoly Central and the Vellore Jails, the admission-rates were higher than in the previous year, but the death-rates were 16·81 and 5·50 against 21·28 and 16·03, and the number of deaths only 10 and 4 against 11 and 13 respectively in 1884. In the Vellore and Rajamundry Central Jails there were no deaths from bowel diseases, and the Coimbatore Jail is the only one of the 5 in which bowel diseases were prevalent. Bowel diseases caused 7 of the 16 deaths recorded in the Coimbatore Central Jail, 1 of 10 in the Trichinopoly Central Jail and 1 of 6 in the Madras Penitentiary. Of the 47 deaths in these 5 jails 9 were due to bowel diseases, and 7 of the 9 occurred in the Coimbatore Central Jail. Of the 5 large jails in the Madras Presidency, fevers were most prevalent in the Rajamundry Central Jail, respiratory diseases in the Madras Penitentiary, and bowel diseases in the Coimbatore Jail. Bowel diseases prevailed also to some extent in the Rajamundry Jail, but did not prove fatal. Of the 27 jails under consideration 7 had an admission-rate of over 1,000 per 1,000, the

highest being 2,111 at Chittoor. The lowest admission-rate was 139 at Bellary. The highest death-rates were in the Nellore (48·19), Calicut (45·45), and Berhampore (42·02) jails; the lowest 2·52 in the Salem, 4·18 in the Madura, 5·08 in the Vizagapatam, and 5·50 in the Vellore jails. The Trichinopoly and Rajamundy District jails, however, had no deaths. Cholera occurred in the Trichinopoly Central jail, causing 3 admissions with 1 death; in the Cuddalore jail, 2 admissions with 1 death, and in the Kurnool jail, 1 admission with 1 death.

Notwithstanding the greater prevalence of cholera the health of the Bombay prisoners was decidedly better than in the previous year. The admission (645), daily sick (25), and death-rates (33·76), were all reduced. Although the rate of mortality from cholera (2·62) rose by over 2 per 1,000, this was more than counterbalanced by a fall in that for bowel diseases of over 2·25 per 1,000, and in the rates of mortality from some other diseases. The admission and daily sick rates were lower than those of any since 1877, as was also the death-rate from bowel diseases. The death-rate from all causes was lower than that of any year with the exception of 1882. The admission-rates for fevers, bowel diseases, respiratory diseases, hepatitis, rheumatism, abscess, and ulcer, and injuries were all diminished in 1885, as also the death-rates from fevers, bowel diseases, respiratory diseases, and anæmia. There was an increased rate of admissions from cholera, spleen diseases, and scurvy, and of mortality from cholera, phthisis, and spleen disease.

Taking the 28 jails of the Bombay Presidency, including 3 with very few prisoners, 18 had less sickness than in 1884, and 10 more; while 15 recorded a higher rate of mortality and 12 a lower. Four jails contained on an average over 500 prisoners, namely, Hyderabad, Tanna, Yerrowda, and Bijapur Gang, and one, Shikarpur, nearly 500. Of these, Hyderabad, Shikarpur, and Tanna had more sickness than in 1884, while Yerrowda and the Bijapur Gang had less. Yerrowda and Tanna recorded higher mortality ratios than in 1884, but excluding cholera the ratio in Tanna is below that of 1884. Half the mortality of the Tanna jail was due to cholera. The relatively great sickness of the Yerrowda jail was not of a fatal type, whilst the sickness of the Hyderabad jail was very fatal. In all these 5 jails fevers were the chief causes of sickness and next bowel complaints, except in the Yerrowda jail, where respiratory diseases were more frequent than bowel complaints. The foremost place as a cause of death was taken by respiratory diseases in all jails (if we exclude cholera at Tanna), except the Bijapur Gang and the Ahmedabad, Surat and Kolhapur jails in which bowel diseases were the chief cause. Respiratory diseases caused 10 out of 23 deaths at Hyderabad, 9 out of 22 at Shikapur, 3 out of 22 at Tanna, 4 out of 17 at Yerrowda, and 2 out of 20 in the Bijapur Gang. Bowel diseases caused 1 out of 23 deaths at Hyderabad, 2 out of 22 at Shikarpur, 1 out of 22 at Tanna, 4 out of 17 at Yerrowda, and 4 out of 20 in the Bijapur Gang. Fevers caused 6 out of 22 deaths in the Shikarpur jail. The Shikarpur and Hyderabad jails are in Sind, where respiratory diseases, especially pneumonia, are very prevalent and fatal, both in jails and out of them, in the cold season. Of the 28 jails 6 had an admission-rate of 1,000 per 1,000 or over, the highest rates being 1,575 at Poona and 1,198 in the Nara Gang. The lowest admission-rates were 70 at Aden and 202 at Ahmedabad. The highest death-rates were 120·32 in the Nara Gang and 86·71 at Surat. In the Bombay jails 38 cases of cholera occurred with 18 deaths; and of these 20 cases with 11 deaths occurred in the Tanna jail. The greatest number of deaths from fevers occurred in the Nara Gang and in the Shikarpur and Ahmedabad jails; from bowel complaints in the Nara Gang and in the Ahmedabad and Surat jails; from respiratory diseases in the Sind jails.

The admission and daily sick-rates (1,353 and 49 per 1,000) among the convicts in the Andamans were even better than those of the preceding year, and were the most favourable since 1877. But the death-rates from all causes (17·66) and from bowel diseases (2·77), were higher than in the previous year, though still lower than those of any other year of the series. There was an increase in the rate of admissions from fevers, bowel diseases, hepatitis, spleen, scurvy, and venereal diseases; and in the rate of deaths from apoplexy, bowel diseases, spleen, respiratory diseases, anæmia. There was a decrease in the rate of admissions from respiratory diseases, phthisis, dropsy, anæmia, rheumatism, abscess and ulcer, and in the rate of deaths from fevers, phthisis, dropsy, &c. Next to fevers the highest admission-rates were due to injuries and abscess with ulcer. With a strength of 11,551 against 11,686 in 1884, there were 204 deaths against 184 in 1884. The principal causes of the 204 deaths were respiratory diseases (36), phthisis (33), bowel diseases (32), wounds and accidents (22), and fevers (16).

The foregoing remarks show that the jails of Assam, followed next by those of Bengal, were by far the most unhealthy, while those of Madras and Berar were the most healthy. The Central Provinces recorded the highest death-rate, mainly due to the incidence of cholera in one jail, and to bowel diseases in most of them. The Andamans, with a high admission-rate and a low death-rate, are contrasted with Bombay with a low admission-rate and a high death-rate. This peculiarity of Bombay was due to fatal cholera and to the fatal pneumonia of Sind, and shows that as far as other ordinary causes of disease go the Bombay jails were healthy. But even if we take the cholera and pneumonia deaths into consideration, the ratio of sickness was lower in Bombay than in either Madras or the North-Western Provinces and Oudh, which show comparatively low or medium admission-rates and comparatively low or medium death-rates.

General Population.

The highest birth ratios were recorded in the Central Provinces (45·36 per 1,000), Berar (42·9), and the North-Western Provinces, with Oudh (41·24), and the lowest in Bengal (24·71) and Burma (25·51), excluding Mysore and Coorg where the statistics are not reliable. Compared with the preceding year, the provincial birth-rates of 1885 were higher in seven provinces and lower in three, namely, the North-Western Provinces with Oudh, Punjab, and Mysore, while in Madras the ratio was the same in both years. The greatest excess in the birth ratios of 1885 over those of 1884 was recorded in the Central Provinces where it amounted to 3·61 per 1,000, whilst the greatest reduction occurred in the Punjab to the extent of 4·14 per 1,000. The maximum birth ratio recorded in any district was 53·76 per 1,000 in the North-Western Provinces, and the lowest 7·94 per 1,000 in a district of Bengal. The most uniform district results in birth registration were obtained in Berar, where the maximum and minimum ratios varied only to the extent of 8·6 per 1,000, whilst in Bengal, where these varied much, the extreme difference amounted to 45·29 per 1,000. The next most uniform results to Berar were those of Assam where the maximum and minimum birth ratios differed by 16·36 per 1,000, and those of Central Provinces where the difference was 16·86 per 1,000. In all provinces except Bengal the birth-rate exceeded the death-rate. The highest mortality was recorded in the Central Provinces, namely, 34·21 per 1,000, and next in Berar, namely, 34·0, and the lowest in Burma, namely, 19·89, and Madras, namely, 21·8 (excluding Mysore and Coorg). The most uniform results were again obtained in Berar, where the difference between the maximum and minimum district ratios was 13·8 per 1,000, the next best being a difference of 16·52 in Burma and 20·2 in Madras. The greatest differences were recorded in the Punjab, namely, 37·0, North-Western Provinces 33·93, and Central Provinces 33·61. The highest district ratio registered was 56·35 in the Central Provinces and the lowest 11·64 in Burma. Cholera gave rise to the highest mortality in Bengal, Central Provinces, Burma, Madras, and Bombay, in each of which the ratio was between 2·0 and 3·0 per 1,000. Small-pox gave rise to the highest mortality in Madras, fevers in the North-Western Provinces, and bowel complaints in Berar.

The vital statistics of Lower Bengal are still far from accurate, and in 1885 they have been rendered even more imperfect by the omission of many thousand deaths due to inundations which, for unavoidable causes, totally escaped registration. An average birth-rate of only 24·71 per 1,000 in 46 selected towns with a mean excess of deaths over births at the rate of 6·99 per 1,000 in a populous province like Bengal must be far from the truth. Nor can a death-rate of over 22·74 per 1,000 for the province be credited, especially during so unhealthy as year as 1885. Although the total birth and death ratios are somewhat greater than those of 1884, yet a comparison of them with the ratios of other provinces and an examination of the birth and death-rates of individual districts shows that they are still much under the truth. Even in the districts where special attempts were made to secure accurate statistics the results were hardly satisfactory. In Monghyr, where special exertions were made in this direction, the chief town of the district recorded a birth-rate of only 24·33 and a death-rate of 32·26. In Midnapore, where much attention is stated to have been bestowed on the subject, the head-quarters town had a birth-rate of only 18·20, and the district a death-rate of only 20·40 per 1,000. Though the compulsory Registration Act is said to have been in force in 117 towns and one rural circle, the birth

registers were kept up in only 46 of them. Under recent orders the work of registration in towns will be carried on henceforth by municipal agency and better results for the province may be looked for. The birth and death-rates of Calcutta were nearly the same as in the year before, the figures being respectively 19·29 and 29·33 per 1,000 against 19·13 and 30·59 in 1884. In the Port of Calcutta the European seamen seem to have suffered much less even in respect of cholera than in any of the preceding five years.

During 1885 no change was effected in the agency or procedure of recording vital statistics in the North Western Provinces with Oudh. The birth registration has been in force since 1879, and the recorded results of the year under review testify to the fact that in most of the districts, if not in all of them, there has been on the whole continuous improvement. The births of the year amounted to 1,819,279, which yielded a ratio of 41·24 per 1,000 of population against an average of 40·5 in the four preceding years. But the district ratios varied considerably. Of the 49 districts in the province, 4 had birth-rates ranging between 50·54 and 53·76 per 1,000; 24 between 40·02 and 48·90; 18 between 30·28 and 39·93; and 3 between 24·0 and 25·79. The last group consists of the districts of Kumaon, Dehra Dun, and Mainpuri where special difficulties have to be overcome. The excess of male over female births was on an average 11·14 per cent., but as it was made up of extremes varying from 4·13 in Garhwal to 27·96 in Muttra, it can hardly be believed to indicate the true proportion which the birth of boys bears to that of girls in these provinces. Deaths were less numerous than births in all but 10 districts, of which Bulandshahr headed the list with a mortality excess over births of not less than 14·81 per 1,000. The mortality of the year stood at 31·98 per 1,000, or an equivalent of 1,410,639 deaths; of these, 744,039 were males and 666,600 were females. These figures are somewhat lower than those for 1884, which was an unhealthy year in these provinces. For every hundred deaths among females, there were on an average 111·61 deaths among males. The death ratios of individual districts disclose greater variations than in the case of births, and consequently point out to greater imperfection in registration. Dehra Dun had the lowest death-rate, 20·56, and Bulandshahr the highest ratio, 54·49. In the latter district the excessive prevalence of fevers accounted for the bulk of the mortality. Among the municipalities the minimum mortality 16·29 was recorded in Dhaurahra and the maximum 111·77 in Sikandrabad, a town in Bulandshahr. A little less than one-half the total provincial mortality occurred among children under five years of age.

The registration of vital statistics in the Punjab appears to have received a fresh impulse from the new mode of compiling primary returns which was introduced in the beginning of 1884, although the Sanitary Commissioner does not think the new system any improvement upon the older one. But the success which at first attended these efforts does not appear to have been maintained. The birth-rate of the province which had risen from 39 per 1,000 in 1883 to 42·98 in 1884 fell to 38·84 in the year under review; and while the lowest birth-rate in any district, omitting Simla and a few frontier districts, stood at not less than 34 per 1,000 in 1884, in 1885 the minimum ratio in the same districts did not exceed 26·75. The mortality of the province during the year under review averaged 27 per 1,000 against 35 in 1884. This decrease was to a certain extent due to the healthiness of the year, but the great variation in the ratios of individual districts ranging between 13 per 1,000 in Peshawar and 50 in Delhi, and the remarkably low rate of death in 23 out of a total of 31 districts makes it probable that imperfect registration had also something to say to it.

The registration of vital statistics in the Central Provinces is conducted more accurately than in many other parts of the country. But the smaller ratios of birth and deaths in the majority of the towns as compared with the figures for the rural circles, the great variations in the death-rates of individual districts and the large number of convictions in municipalities for neglect of birth registration, would show that the statistics of both rural and urban circles are still susceptible of improvement. The population under registration during 1885 was 8,817,185. Among these the number of children born during the year was 206,439 boys and 193,532 girls, or a total of 399,971, which gives an average birth-rate of 45·36 for the province as a whole against 41·75 in 1884. This ratio is the highest recorded since 1881. Examined by districts, it will be seen that excepting Burhanpur, where the ratio was 33·49, in all the other districts the range of variation in the birth-rates was small, namely, from 41 to 50, or less than 10 per 1,000. The average birth-rate of the

principal towns was 37·65 against 46·09 per 1,000 in rural circles. The excess of male over female births was 6·67 per cent. In all districts, with the exception of Chhindwara and Seoni, where severe epidemics of fever carried off a considerable number of victims, the births were more numerous than the deaths. The deaths of the year amounted to 301,684 or at the rate of 34·21 per 1,000 against 27·30 in 1884 and 30·70, the mean of the preceding five years. Of the total mortality, however, nearly one-half was contributed by children under five years of age. In rural circles the death-rate was in the proportion of 34·48 per 1,000, and in towns 31·35. On the whole, therefore, the year under review was more unhealthy than the one preceding it.

For some years past the statistics of births and deaths in Berar have been recorded with greater correctness than in most of the other provinces of India, and the results of 1885 indicate a still nearer approach to accuracy. Some defect in the registration of vital statistics, however, is still observable. The births registered during the year amounted to 58,365 boys and 54,416 girls, or a total of 112,781 children, which yielded a ratio of 42·9 per 1,000, the highest figure ever recorded in the province since the commencement of registration in 1868. This was made up of ratios varying from 39·2 in Akola to 47·8 in Buldana. In rural circles the average birth-rate was 43·3 per 1,000 and in towns 40·8 per 1,000. But the great variation in the birth-ratios of towns from a minimum of 26·4 in Paratwada to a maximum of 56·5 per 1,000 in Sirasgaon shows that there is still room for improvement. The excess of male over female births was on an average 7·3 per cent. Although the year on the whole was an unhealthy one, yet nowhere did the mortality exceed the births. There were altogether 89,558 deaths, or at the rate of 34·0 per 1,000 against 24·6 in 1884. This increase was partly due no doubt to improved registration, and greatly to the increased prevalence of sickness and mortality all over the country. In one only of the six districts was the death-rate so low as 25·1; in the others it varied from 30·3 to 38·9 per 1,000. For every hundred deaths among females there were 114·2 deaths among the males. In towns the death-rate stood at 36·6 per 1,000, but in the rural circles it did not exceed 33·7. More than one-half the total number of deaths during the year occurred among children under five years of age.

The new system of collecting vital statistics introduced in Lower Burma in 1884 continued in force throughout the year 1885. The result has been a slight improvement in both the total birth and death-rates. Nevertheless, if these ratios be compared with those of other provinces in India in which a fairly accurate registration has been attained, they will still be seen to be much below the probable actual ratios which prevail. The birth-rate of the province averaged 25·51 per 1,000 against 22·66 in 1884. It was, however, made up of extremes varying from 16·60 in Toungoo to 34·19 in Tharrawaddy. But this variation was still greater in towns where the birth-rates ranged between a minimum of 7·81 and a maximum of 50·59. The death-rate for the province was 19·89 against 18·95 in 1884; but this is a mean of district ratios varying from 28·16 in Thayetmyo to 11·64 in Tavoy. The excess of male over female mortality was very great, namely, 26 per cent., whilst the excess of male births over female births was only 6 per cent.

As in the preceding year, the registration of vital statistics in Assam during 1885 was carried out in all the districts in the plains and in certain selected tracts in the Khasi and Jaintia Hills and in the Garo Hills; but in order to avoid vitiating the provincial statistics the imperfect results of Tura and Rewak in the Garo Hills were very properly excluded from the general tables. Excluding the tea gardens, the total population under registration numbered 4,526,959. And among these a birth-rate of 27·95 per 1,000 was registered; the male births exceeding the female by 9·48 per cent. This was an improvement upon the figures of the past two years, when the birth-rates stood at 26·60 in 1884 and 23·91 per 1,000 in 1883. The loss to the province by deaths amounted to 126·344 or at the rate of 27·91 per 1,000 against 29·36 in 1884 and 27·14 in 1883. The results obtained in the *sadar* and sub-divisional towns of Assam, where registration is compulsory, were still more unsatisfactory. Here among a total population of 100,225 the recorded births numbered only 2,159 and the deaths 2,743, or at the rates of 21·5 and 27·3 per 1,000 respectively. In tea plantations the mean number of coolies employed during the year was 289,977. Among these there were 9,235 births and 10,295 deaths, or at the rates of 31·84 and 35·50 per 1,000 respectively. Here the smallness of the birth-rate as compared with the mortality is attributed to the smaller number of women among the garden

labourers than would obtain in ordinary communities. These results on the whole indicate that, though some progress has been made in recording the birth statistics of the province, the registration of deaths generally, and in the towns especially, is still very imperfect.

The total births of the year in the Madras Presidency amounted to 824,042, or an equivalent of 29·3 per 1,000 of population, which was exactly the same as the ratio for 1884. The deaths numbered 615,449, or at the rate of 21·8 per 1,000, against 23·1 in the preceding year. That these ratios are much under the truth would appear not only by comparing them with the statistics of some of the other provinces where fairly accurate records are kept up, but also by examining the figures of the municipal towns in the Presidency itself where registration is carried on under legal enactment, and where the results show a birth and a death-rate of not less than 33·3 and 29 per 1,000 respectively in 1885. Besides, the great variations in the birth and death-rates of individual districts indicate that little reliance can be placed on the accuracy of the records kept in most of them. Again, while the birth of boys exceeded that of the girls by 4·6 per cent., the mortality among males preponderated over that of the females by 6·3 per cent. The total deaths were less numerous than in the preceding year. This diminution is attributed partly to cholera and small-pox having been less fatal than in the year before.

The steady increase in the birth ratios of Bombay Presidency as a whole since 1875, with the exception of the three years 1877, 1878, and 1879, when the country suffered considerably from famine and its attendant unfavourable circumstances, is very satisfactory. The number of male births was 298,406, and of female births 274,025, or a total of 572,431 children, yielding a ratio of 34·79 per 1,000, against 32·50 in 1884, and 23·82, the mean of the 10 years 1875–84. Of the 24 districts comprised in this Presidency, 15 recorded birth-rates ranging from 32·81 to 47·80, five from 21·66 to 29·86, and the remaining four from 13·17 to 19·03. In the towns of this Presidency the birth ratios varied from a minimum of 11·41 per 1,000 to a maximum of 49·23. The average excess of male over female births, namely, 8·90 per cent., is probably near the truth, but an excess of male births by 43·68 per cent. as at Hyderabad and 55·07 per cent. as at Upper Sind is evidently correct. The total loss of life from natural as well as accidental causes during the year amounted to 473,591, or 28·78 per 1,000 of population, against 24·82 in 1884 and 25·58 during the preceding 10-year period. The district death-rates varied from 14·51 in Thar and Parkar to 37·90 per 1,000 in Broach. In 5 districts the mortality was below 20 per 1,000; in 8 it ranged between 20 and 30, and in the remaining 11 it was above 30 per 1,000. Excluding Sind, where registration is still very imperfect, the death-rate of 1885 for the Presidency would be 30·34, a ratio which is probably near, though still perhaps a little below, the truth. As usual, a little less than one-half the total mortality occurred among children under five years of age.

The results of 1885 in Coorg indicate some improvement in the registration of vital statistics among the general population, the birth-rate having stood at 17·48 and the death-rate at 16·57 per 1,000, against 14·87 and 15·08 respectively in 1884. As in the preceding year, not a single death was recorded from cholera. Of the 248 deaths due to small-pox, only 28 are shown to have been among children under 12 years of age. This is scarcely credible. Of the total 2,956 deaths which occurred in the Province during the year, all but 600 were due to fevers.

History of Chief Diseases.

Cholera.

The year 1885 was one characterised by great prevalence of cholera for India, taken as a whole, although certain portions of the continent suffered less, or, at any rate, not more than usual. Throughout those parts of India in which the registration of deaths is effected, 385,928 deaths were ascribed to this cause, against 287,609 in 1884 and 248,860 in 1883. Even assuming that registration has developed in accuracy, the increase of the year under report shows that the causes which produce this disease operated with considerably greater force than they did during the two preceding years. The following table gives an analysis of the total number of deaths recorded throughout India into the numbers contributed by each of the 14 provinces of India, and corresponding figures have been introduced for each year since 1875.

Annual Deaths from Cholera in India, 1875 to 1885.

Province.	Population.	Deaths from Cholera.										
		1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
Bengal* - -	66,163,884	109,988	196,590	155,305	95,192	136,363	39,643	79,180	182,352	90,439	134,421	173,767
Assam - -	4,526,959	6,618	8,615	11,377	6,732	17,415	2,803	5,010	21,055	14,908	22,276	7,753
North-Western Provinces and Oudh - -	44,107,369	64,427	48,311	31,770	22,221	35,892	71,546	25,865	89,372	18,160	30,143	63,457
Punjab - -	18,842,264	6,246	5,736	29	213	26,135	274	5,207	39	190	614	1,936
Central Provinces	8,817,185	14,643	20,124	3,418	40,985	27,575	330	9,140	11,932	16,235	149	21,868
Berar - -	2,630,018	22,465	2,683	842	34,306	223	1	3,404	3,573	27,897	87	3,683
Rajputana - -	†	1,203	283	60	2,393	918	—	197	1,327	797	1,297	1,695
Central India -	†	2,555	1,929	926	8,047	2,734	299	581	1,562	1,740	1,018	4,624
Bombay - -	16,454,414	47,573	32,117	57,228	46,743	6,937	684	16,694	7,904	37,954	13,804	37,287
Hyderabad -	†	10,891	5,582	7,414	6,696	6	—	1,721	150	1,947	2,479	1,387
Madras - -	28,118,178	94,547	148,189	357,430	47,167	13,296	613	9,446	23,604	36,284	75,476	58,109
Mysore - -	4,092,648	2,504	12,087	2,902	723	14	25	25	893	124	330	2,677
Coorg - -	178,302	‡	210	‡	49	—	—	3	31	—	—	—
Lower Burma -	3,653,629	761	3,678	7,276	6,759	1,828	2,638	5,239	7,177	2,185	5,515	7,685

* Excluding Calcutta. † Population not known. ‡ Statistics not available.

This table shows that in only three provinces, namely Assam, Hyderabad, and Madras were the aggregate number of deaths from this cause less than they were in the preceding year. Excess over the previous year's figures is most noticeable in Bengal, North-Western Provinces, Central Provinces, and Bombay, in each of which it amounted to over 20,000 deaths.

In the following table several data of interest are brought together for comparison, the death-rates being expressed in ratios per 1,000 :—

Province.	Mortality in 1885.	Average mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in rural circles.	Maximum mortality in towns.	Month of Maximum prevalence.
Bengal - -	2·62	1·59	5·22	2·53	12·6	6·77	28·76	August.
Assam - -	1·71	2·92	2·18	1·70	11·5	2·50	11·57	May.
N.-W. Provinces and Oudh - -	1·44	1·06	1·47	1·43	6·4	5·69	18·61	October.
Punjab - -	0·10	0·07	0·26	0·09	0·61	1·43	7·05	November.
Central Provinces -	2·48	0·90	1·88	2·54	7·6	7·52	20·54	July.
Berar -	1·4	2·7	2·0	1·4	7·0	2·2	11·5	September.
Lower Burmah -	2·10	1·27	3·13	1·97	1·5	3·64	42·44	August.
Madras - -	2·0	1·0	3·3	1·9	14·2	4·4	10·8	January.
Bombay - -	2.27	0·94	1·93	2·32	9·1	10·63	28·39	July.

This shows that in Assam and Berar alone were the ratios of death during the year below the past quinquennial averages, that in the North-Western Provinces and Punjab they were but little in excess of these averages, and that in the remaining provinces they were considerably in excess. With reference to the ratios contrasting urban with rural mortality, it is remarkable that in the Bombay Presidency and Central Provinces did the rural mortality exceed the urban. In Bengal the urban mortality was considerably in excess of the rural. With reference next to the per-centages of villages recording deaths as affording some index to the diffusion of the disease over provinces the table shows Madras, Bengal, Assam, and Bombay, to have been most largely affected. The next two columns are introduced to show the foci of greatest intensity of incidence. The highest ratio recorded for any single district in India was 10·63 per 1,000 in Bombay, and next 7·52 in the Central Provinces. Amongst towns the high ratio of 42·44 per 1,000 was recorded in Burma.

In Bengal the year was one of great prevalence of the disease which gave rise to 173,767 recorded deaths equivalent to 2·62 per 1,000 of population against 1·59 the average of the preceding five years. The disease was also widely diffused for 98 per cent. of registering circles returned deaths from this cause and 12·6 per cent. of villages. The Orissa Division suffered by far the most severely (5·14), the Burdwan with Presidency (3·09), and Bhagalpur (3·50) Divisions next in order.

The ratios of 1885 exceeded the quinquennial averages in every division; but most largely in the Bhagalpur, Orissa, Chota Nagpur, Patna, and Rajshahai Divisions. The highest district ratio was recorded as usual in the suburbs of Calcutta where it was 7·46 against 7·95 the average of the preceding five years; and the next highest were in Birbhum, 6·87 (against 1·57 for preceding five years), and Maldah 6·17 against 1·18. In Puri, Cuttack, and Rajshahai the ratios exceeded 5 per 1,000. The mortality in urban circles was 5·22, whilst in rural circles it was only 2·53 against 3·32 and 1·52 the corresponding ratios of the previous five years. The town ratios varied from 0 to 28·76 in Puri: the next highest ratios were 27·91 in Sitamarhi and 19·61 in Jamalpur.

The disease was less prevalent than usual in Assam as the total mortality equalled 1·71 per 1,000 against 2·92 per 1,000 the average of the previous five years. In the Lakhimpur district alone was the mortality of the year greater than the quinquennial average. In the Darrang and Nowgong districts there was a remarkable reduction, and in the Kamrup district also the death-rate was considerably below the average of the preceding five years. With reference to the distribution of the disease, it may be noted that 29·3 per cent. of registering circles and 11·5 per cent. of villages recorded deaths. The diffusion of the disease varied, however, considerably in the several districts. The district mortality was 1·70 and the town mortality 2·18.

It is extremely satisfactory to notice the continued decrease of sickness among the immigrant coolies into Assam as compared with the preceding year. The number which arrived at Dhubri was 15,568 against 26,270 in 1884, the large decrease being due, it is stated, to lessened demand for them consequent on the exceptionally large numbers imported during the previous year. On the way to Dhubri by rail 10 died, mostly from cholera, but this mortality was considerably less than that which took place in 1884, owing to the greater attention paid to them for example in arranging suitable halts for feeding, &c. While at Dhubri 35 died or 0·22 per cent.; of these deaths 26 were due to cholera. The disease appeared among them at Dhubri in February and continued until June. It is stated that several labourers arrived with the disease and others were attacked a few hours after arrival. No attendant on the sick at Dhubri contracted the disease. At Dhubri 15,503 embarked, and 24 of these died on the river, equivalent to 0·15 per cent. against 0·26 in 1884. Of these deaths 16 were due to cholera against 37 in 1884.

Turning now to the coolies who entered by the Goalundo route it appears that 2,543 embarked there against 2,888 in 1884. Seven died *en route*, 2 between Goalundo and Dhubri, 1 between Dhubri-Gauhati, 1 between Gauhati and Tezpur, and 3 between Tezpur and Dibrugarh. The death-rate was 0·27 per cent. against 0·83 in 1884.

No overcrowding occurred either in the depôts or on the steamers. The larger steamers carried from 282 to 235 coolies while the smaller carried 158 to 132. The time spent on the trip from Dhubri to Dibrugarh varied from 4 days 11 hours to 5 days 9 hours.

Cholera prevailed in the North-Western Provinces somewhat more extensively than usual, the total mortality having been 1·44 against 1·06 the average mortality of the previous 5 years. As regards the diffusion of the disease over the province it may be noted that 55·5 per cent. of registering circles and 6·4 per cent. of villages recorded deaths from this cause. The disease was most fatal in the Fyzabad and Rae Bareli Divisions, the approximate death-rates in the districts of these divisions being about 4 per 1,000. In the Sitapur, Lucknow, Allahabad, and Benares Divisions the death-rates were between 1 and 2 per 1,000, whilst in the Kumaun, Rohilkund, Meerut, Agra, and Jhansi Divisions they were under 1 per 1,000. The highest death ratio in any single district was 5·67 per 1,000 in Bahraich (Fyzabad Division), and in 4 of the 49 Districts the deaths were confined to a few sporadic cases. These last-mentioned districts are Bijnour, Pilibhit, Muzaffarnagar and Hamirpur, but we might add to these the following in which the mortality ratios were below 0·1—Kumaun, Garhwal, Tarai, Saharanpur, Meerut, Bulandshahr, Jhansi, and Etawah. Of these Garhwal and Pilibhit have only suffered during 3 of the last 16 years from cholera, Meerut 4 times, Muzaffarnagar and Etawah 5 times, Bijnour and Saharanpur 6 times, Kumaun and Bulandshahr 7 times, and Tarai 9 times.

With regard to the seasonal prevalence of the disease during the year under review, the only noteworthy point is the continuance of high mortality during the last quarter of the year. This unusual condition the Sanitary Commissioner attributes to the early cessation of the rains, namely on the 8th September. He writes—"certainly in no "other year of the mortuary record have the rains ceased at so early a date or has "cholera prevailed to such extent in the last quarter of a year." The urban mortality was 1·47 per 1,000, whilst the rural mortality was 1·43.

Cholera in the Punjab gave rise to 1,936 recorded deaths, equivalent to 0·10 per 1,000 of population, against 614 deaths or 0·03 per 1,000 during the previous year. The last quinquennial average mortality was 0·07. The disease was therefore more prevalent than usual, but it was not widely diffused, for only 19·5 per cent. of registering circles and 0·61 per cent. of villages recorded deaths. Nearly one-third of all deaths took place in the Dera Ismail Khan district, namely 603, yielding a ratio of 1·36 per 1,000 of its population. Next to it the Gurgaon district suffered most, recording 283 deaths or 0·44 per 1,000 of population; Karnal, Lahore, Dera Ghazi Khan, Rawal Pindi, and Mooltan, come next in order of highest aggregate deaths, ranging from 182 to 105 deaths. All these districts are sparsely populated, Dera Ismail Khan having the smallest number of inhabitants per square mile of any of the districts of the province. In the most populous districts, namely, Delhi, Jullundur, Amritsar, and Sialkot, the numbers of deaths recorded were 21, 0, 63, and 0. The disease made a well-marked beginning during April, the deaths increasing from 78 in that month to 323 in July; thereafter the disease declined slightly during the succeeding three months, but was rekindled during November, when the maximum number of deaths was recorded, namely 464, and the year ended with the disease still giving rise to a considerable mortality. This persistence of the disease towards the close of the year, had it been at that time diffused over the province, would augur ill for the succeeding year; but, as will be shown presently, the disease was then much restricted in the area over which it prevailed, so it may be hoped that it is of no evil significance for the province as a whole. Whilst in the southern district of Gurgaon almost the whole of the mortality of the year took place in June, and in the north-western district of Dera Ismail Khan, all deaths, excepting two, occurred during the last two months. As an illustration of the capriciousness of this disease not only in its selection of site but also of season, it may be noted that whilst the Delhi (672 deaths) and Derajat (778 deaths) Divisions suffered most, the three intervening divisions, Jullundur, Lahore, and Rawal Pindi, recorded only 6, 366, and 114 deaths respectively, while the most northern division of Peshawar recorded no mortality at all. Moreover, while the disease, as already stated, was concentrated in the Dera Ismail Khan district during November and December, in the neighbouring district of Dera Ghazi Khan the disease was all over by the end of July. Now Dera Ismail Khan is further up the river Indus than Dera Ghazi Khan, and although the latter is much nearer the railway terminus, the former suffered nearly four times as much in proportion to its population as the latter.

The Sanitary Commissioner of the Punjab attempts to connect the prevalence of the disease in the province generally with the return of pilgrims from the Hurdwar Fair; but as many districts, such as Delhi, Rohtak, Ludhiana, Ferozepur, Jullundur, Hoshiarpur, &c., which must also have sent large numbers to this fair, escaped with little or no cholera, this explanation of its introduction into the Punjab cannot be accepted without considerable reservation. He writes:—"The first cases of cholera "in the province were almost all of pilgrims from the Hurdwar Fair. But the "returns show that in the great majority of instances the disease did not assume "an epidemic character in the localities in which the pilgrim cases occurred. This "remarkable immunity may be accounted for by the unusual state of the weather "throughout the province during the months of April and May. The rainfall "returns show that the aggregate provincial rainfall in April was 53·7 inches and in "May 97·1 against an average rainfall of 22·0 and 20·5 inches in these two months "respectively for the previous five years."

The disease was unusually prevalent in the Central Provinces, giving rise to a mortality ratio of 2·48 per 1,000, which was exceeded only three times during the previous 14 years. Every district with the single exception of Chhindwara was attacked, whilst 70·2 per cent. of registration circles and 7·6 per cent. of villages recorded deaths from this cause. The approximate death ratios in each of the divisions of this province is shown in the following statement, and average ratios for the preceding 5 years are also given for comparison:—

	1885.	1880–84.
Vindhyan Division - - - -	2·75	0·85
Nerbudda „ - - - -	2·32	0·72
Satpura „ - - - -	1·05	1·15
Wainganga „ - - -	0·57	1·48
Mahanadi „ - - - - -	4·99	0·41

The Mahanadi Division not only suffered the highest ratio of mortality (4·99), but it also suffered more in excess of its average than any other division. In the Satpura and Wainganga Divisions the mortality ratio of the year, 1·05 and 0·57, was below the average of the preceding five years. Of individual districts the highest mortality, namely 7·70, was recorded at Raipur in the Mahanadi Division, and the lowest, excluding Chhindwara, in Saugor, namely, 0·04. Of the 20 districts of the province 11 recorded ratios higher than the averages of the preceding five years. Comparing urban with rural mortality, it appears that, whilst in the former circles, the ratio was 1·88, in the latter it was 2·54. The highest ratio recorded in any single town was 20·54 in Drug (Raipur district). During January only six deaths were recorded; but from 110 deaths in February the numbers rose to 5,700 in July. Thereafter the numbers declined from 5,165 in August to 131 in December.

This was a year in which cholera prevailed epidemically in Berar, but the extraordinary alternation of quiescence and epidemic prevalence of the disease in this Province has frequently been noted. During the year 3,683 deaths were due to it against 87 in the previous year, or 1·4 per 1,000 of population against 0·03. Although a year, therefore, of epidemic visitation, it was by no means a year of intense incidence, for during 1875, 1878, and 1883 the mortality ratios from this cause exceeded 10 per 1,000 of population. With such extraordinary oscillations of death-rate a mean of a series of annual mortality ratios conveys little meaning; it may, however, be noted that the approximate mean mortality during the last 18 years (including that under report) is 2·5, the extreme components entering into it being 0 in 1873 (and practically 0 in 1874) and 15·6 in 1878. The Sanitary Commissioner gives a table showing the relationship between cholera deaths and rainfall for 11 years (including 1885). Of these 11 years, 7 may be said to have been years of epidemic prevalence of the disease and 4 of comparative immunity. The aggregate rainfall for the previous period was 256·85 inches, equivalent to a mean annual fall of 36·69 inches; whilst the aggregate fall of the latter period was 128·89 inches, equivalent to a mean of 32·22. Although, therefore, the epidemic years were more rainy than the others, the means do not show any extraordinary excess, certainly nothing at all comparable with the differences in mortality. The average annual mortality of the 7 epidemic years was 5·95 and of the 4 non-epidemic years 0·13. But looking at individual years a relationship between high rainfall and high cholera mortality becomes more striking. Of the 11 years, 3 years—1875, 1878, and 1883—showed a cholera mortality of over 10 per 1,000, and the average rainfall of these years was 44·64; 4 years—1876, 1881, 1882, and 1885—recorded mortalities between 1 and 2 per 1,000, and the average rainfall of these years was 30·73. This latter average is thus below the average of the four years 1877, 1879, 1880, and 1884, which have been noted as non-epidemic, namely, 32·22. The number of years for which data are given are not sufficient to allow of safe generalisation, but, so far as they go, they seem to indicate that years of great rainfall are usually years of high cholera mortality, but that years of average or low rainfall may or not be years of comparatively great cholera prevalence.

In close connexion with this possible relationship between rainfall and cholera prevalence is the nature of the soil. This is described by the Sanitary Commissioner thus:—"The soil almost everywhere in the plains of Berar is black cotton, soil or '*rigar*,' an argillaceous permeable soil, highly hygroscopic and retentive. In the hot weather it becomes very dry and intersected with cracks and fissures, and the ground water lies at a very considerable depth. These physical peculiarities of the soil would account for the connexion of epidemic cholera in Berar with south-west monsoon if it be admitted that moisture is essential to the development of the cholera poison."

Of registering circles 68·9 per cent. recorded cholera deaths and 7·0 per cent. of villages were attacked. This village proportion is small compared with some of the other provinces visited similarly; but villages here are much smaller and more scattered than elsewhere. The total number of persons attacked is stated to have been 8,529, of whom 43·2 per cent. died. Buldana, Akola, Basim, and Wun suffered most severely and Amraoti and Ellichpur least. The epidemic began on 10th May simultaneously in two villages of the Akola and Buldana districts, 70 miles apart from one another as the crow flies. The next districts attacked were Amraoti, 24th May, Ellichpur, 25th May, Basim, 7th June, and Wun, 6th August. For the province, as a whole, deaths increased from May, reaching a maximum in September, and thereafter declined, the year closing with only 15 deaths during December. In districts the

mortality was 1·4 and in towns 2·0. In towns the highest mortality was 11·5 in Pusad (Basim).

The year was one of unusual prevalence of this disease in Burma as the aggregate number of victims to it was exceeded only in 1873 during the time for which we have any statistical records for the province. From 14 to 15 per cent. of villages recorded deaths from this cause, and the provincial death-rate was 2·10 per 1,000, against 1·27, the mean death-rate for the preceding 5 years. The provincial ratio is made up of componont district ratios, varying from 3·61 in Thongwa to 0·05 in Mergui. The Arakan and Irrawaddy Divisions were visited with the greatest severity. April, May, July, and August were the months of greatest mortality from this cause.

In Madras the aggregate deaths from this cause numbered 58,109, or 2·0 per 1,000, against 1·0, the average of preceding 5 years, and 2·7 in 1884. Though very prevalent, therefore, the disease was not so widespread as during 1884. Of 51,978 centres of population, 7,385 contributed towards this mortality, equivalent to 14·2 per cent. Excluding the Madras district, which represents only the *city*, the most populous districts are Tanjore and Malabar, with 583 and 410 inhabitants per square mile respectively, and in these districts cholera mortality equalled 2·3 and 0·9 per 1,000, whilst 5 other districts recorded mortalities exceeding 3 per 1,000, and in South Arcot the highest proportionate mortality was reached, namely, 4·4. In rural circles the death-rate equalled 1·9, while in towns it amounted to 3·3 per 1,000. The incidence of the disease was very great in some towns, *e.g.*, between 10 and 11 per 1,000 in the following :—Cochin (Malabar), Panruti (South Arcot) ; Salur (Vizagapatam) ; between 8 and 10 in 4 towns ; between 5 and 8 in 13 ; in 4 towns only were no deaths recorded. The greatest number of deaths was reported in January—22,885. The mortality fell gradually to a minimum in June : during July there was a slight exacerbation, but thereafter it fell again to a minimum of 664 deaths in December. This would lead to the hope that the epidemic was subsiding, and that the death-rate during the following year would fall.

The Sanitary Commissioner notes that, whilst in 1884 the Southern and Central districts suffered the highest mortality, in 1885 there was a marked decrease of deaths in the south, whilst in the north, on the contrary, the disease gained fresh vitality.

In the Bombay Presidency cholera was greatly prevalent, the total mortality having been 2·27 against 0·94, the average of the preceding 5 years. The increased mortality of the year under report was mainly borne by the Sind and Western Registration districts as shown by the following statement :—

	1885.	1880–1884.*
Western Registration District	2·15	1·32
Central „ „	2·19	2·21
Southern „ „	2·08	1·15
Eastern „ „	0·54	0·47
Sind „ „	4·85	0·11

In the province, as a whole, 82·6 per cent. of registering circles and 9·1 per cent. of villages recorded deaths, but in the villages of the several registration districts the percentages were as follows :—

Western Registration District	7·8 per cent.
Central „ „	14·8 „
Southern „ „	9·8 „
Eastern „ „	5·5 „
Sind „ „	8·3 „

The highest proportion of villages attacked in any district was 28·49 per cent. in Sholapur (Central registration circle) and the lowest 1·23 in Ratnagiri in the same registration circle. The mortality in towns was less than that in rural circles, the ratios being respectively 1·93 and 2·32 per 1,000. The highest ratio recorded in any single district was 10·63 in Karachi (Sind), and in any single town 28·39 in Pandharpur in the Sholapur district (Central registration district). But the ratio here is stated to be misleading, as the population varies largely owing to an important fair which is held there. During January the disease prevailed in 9 districts, during February in 11, and during March in 15. During April the disease abated somewhat in severity as the number of deaths recorded fell, but still gained in diffusion, for 18 districts recorded deaths. In May deaths increased in number, and attaining high

* These ratios are approximate.

proportions in June when every single district recorded deaths, reached a maximum in July. Thereafter, the disease began to decline, and during the last month of the year the smallest number of deaths was recorded, namely, 199 from 9 districts.

With reference to the severity of the disease it may be noted that in the Presidency, as a whole, 57·12 per cent. of those attacked died. For single districts the highest per-centage of deaths was recorded in Bombay City, 76·45, and the lowest, 40·35, in Kaira (Eastern Circle).

The occurrence of an outbreak of cholera in Mooltan is worthy of special note, as this station usually enjoys complete immunity from the disease. The records of past years show that among troops, with the exception of an isolated case during 1881 in the person of a sowar of the 15th Bengal Cavalry, no outbreak of the disease had taken place since 1872. In the last-mentioned year 3 European soldiers of the 41st Regiment were attacked in August, of whom 2 died, whilst of 2 Native followers attacked 1 died. The outbreak of 1885 resembled that of 1872. In this outbreak 4 men of the Manchester Regiment were attacked, of whom 3 died, but the season of occurrence was earlier, namely, in June.

The Principal Medical Officer of the district was of opinion that the disease was introduced from the Indus Valley Railway by returning coolies and artisans, who had been engaged on the extensive railway constructions there actively in progress; but this opinion was based on an insufficient knowledge of the actual progress of cholera through the Punjab, and is opposed to the well authenticated experience of former invasions of the Punjab by the disease which has always been observed to invade from below upwards, and never in the contrary direction. The Sanitary Commissioner with the Punjab Government, with a wider knowledge of the progress of the disease throughout the Punjab, writes as follows:—

"Of the 105 deaths registered in the district, 1 occurred in April, 32 in May, 13 in June, 16 in July, 14 in August, 16 in September, and 13 in October. It has been stated that cholera was imported from Rindli by railway to Mooltan. There is no doubt that several coolies, returning from Rindli, were taken out of the trains at the Mooltan Station suffering from cholera. But it must be remembered that the disease was prevalent in the district some three weeks before it had actually broken out at Rindli. There was a death from cholera in a village close to the Mooltan Cantonment on the 25th of April, and up to the 11th May 27 cases and 11 deaths were reported, whereas cholera first made its appearance at Rindli on the 12th May. Between the 12th of May and 15th of June 41 cases more, with 26 deaths, were reported in the city and neighbourhood of cantonments. On the 15th June cholera appeared among the European troops in the cantonments."

It is thus apparent that the law of invasion from below upwards was maintained during the year under report. It may, in conclusion, be observed that, throughout the whole district of Mooltan, 105 deaths from cholera were registered, a very unusually high number, as during the 12 years 1871 to 1882 only 37 deaths were recorded from the same cause.

The following facts regarding the circumstances attending outbreaks of cholera among troops and prisoners have been extracted from the reports of Medical Officers, who were personally connected with them and have been set forth in the same way in which they have been given in former years.

There is little or no evidence to show that antecedent fatigue exerted any particular influence in bringing about an attack. In most instances the first case presented no history of previous fatigue or intemperance, although in a few such a history is given. Among European troops, for example, the first man attacked at Agra is said to have been attacked on the day following that on which he took a long 9-mile walk which he did in consequence of feeling generally in ill health. At Nowshera the first man attacked had been drinking heavily just before. At Negundi the first case occurred in a man who had fatigued himself considerably by climbing the surrounding hills all day. Among Native troops a previous history of indiscretion in diet often occurs, but during 1885 only 2 such cases were noted. Among prisoners it not unfrequently happens that the first cases occur among prisoners in hospital for treatment for other diseases. During 1885, six such cases occurred. In 2 cases it is noted that the prisoner had been on hard labour just before attack.

Among European troops of 30 communities attacked, in 13 diarrhœa was not prevalent, in 9 it was slightly prevalent, and in 8 distinctly prevalent. At Allahabad and Quetta, where a considerable number of cases occurred, diarrhœa was prevalent. Among Native troops of 29 communities attacked no prevalence of diarrhœa was noted

in 23, slight prevalence in 4, whilst in 2 cases no particulars are given. In jails of 36 communities attacked diarrhœa was not prevalent in 12, slightly prevalent in 12 and distinctly prevalent in 12.

In the case of European troops complete data are given in the cases of 18 attacked communities; these occupied 292 buildings of which 57 furnished cases. At Quetta, where the largest number of cases occurred, the data are unfortunately not available. At Allahabad 6 of 22 buildings furnished cases. Native troops occupy small huts, and consequently the 23 attacked communities, for which we have complete information, occupied 3,308 buildings of which 49 furnished cases. For jails we have complete information in the cases of 26 attacked communities. These occupied 532 buildings and 127 furnished cases. The greatest proportion of buildings furnished by jails is as usual due to the greater concentration of buildings necessary for such places.

No special atmospheric or telluric conditions are indicated as favouring outbreaks. The usual general statements recur in reports. Excessive rain or deficient rain, great heat or cool pleasant weather, stillness of air or tempestuous weather, clear or cloudy atmosphere are all noted in connexion with outbreaks. Electrical disturbances are noted in a few instances, and in one case an earthquake happened to coincide with an outbreak. At Quetta great diurnal variation of temperature is noted, and the Medical Officer writes:—"I also noticed several times a peculiar mist all over the "hills as if a sand-storm were passing. I noticed cholera to appear 12 to 14 hours "after such a phenomenon."

Among European troops of 30 communities attacked complete information is given in 29. In these 29 communities 355 cases were treated and 315 persons attended on them of whom 6 were attacked. The particulars of these 6 cases are shortly as follows:—

(1.) Station hospital Calcutta, of 16 attendants 1 was attacked. The man had recently been a patient in hospital and was discharged, but volunteered as a sick attendant on the day he was attacked.

(2.) At Gwalior Fortress, 1 of the 13 attendants was attacked. He had been in close attendance on 2 comrades, but had not been in close communication with them for 36 hours before he was attacked.

(3.) At Nowshera 1 of 15 attendants was attacked. He had volunteered to attend on a comrade who was suffering from cholera.

(4.) and (5.) At Quetta 2 of 36 attendants were attacked. The Medical Officer writes:—

> "Both these men were attacked with the disease while they were actually engaged in attendance on cholera patients, and the last case attributed his attack to the offensiveness of the stink from one of the patients—'stool of reaction.' But these orderlies were suffering at the time of their attack from self-imposed over-fatigue and want of sleep, and both of them had been found on the night previous to their being attacked (as well as on former occasions) asleep alongside their patients while their fellow orderlies were keeping watch with no clothing over them. Hence the circumstances connected with these two attacks amongst the attendants were not such as to lead one to the conclusion that they were due to such attendance except in so far as that attendance may have rendered them in a more favourable condition to be affected by, and a less favourable condition to resist any predominating and untoward external influences."

(6.) At Zandra and Sakholi one of 22 attendants was attacked, but no particulars are given.

Thus of the 102 attendants enumerated in the above cases who attended upon 88 cases 6 were attacked. Excluding these cases there remain 213 attendants upon 267 cases, and not one of these was attacked. In the case of the single community in which information is not given regarding the number of attendants on 4 sick persons it is nevertheless noted that none of them were attacked. Turning next to Native troops it appears that amongst 28 attacked communities 354 persons attended upon 91 cases, and of these only 1 at Allahabad was attacked. He was one of 6 attendants. In jails we have complete information in the case of 35 attacked communities. Here 390 persons attended upon 390 sick; of these 12 were attacked. At Hazaribagh where 31 attended upon 79 sick, 8 were attacked, and at Bassein where 30 attended upon 63 sick, 2 were attacked. No particulars are given of these attacked attendants;

Communities.	Number of cases of Cholera treated.	Medical Officers, Hospital Assistants, and other Attendants on Cholera Cases.		Per-centages of Attendants attacked.
		Number.	Number of these attacked with Cholera.	
European Troops	359	315	6	1·90
Native Troops	92	354	1	0·28
Jails	444	412	14	3·39
Total	895	1,081	21	1·94

Among European troops in the great majority of cases no sanitary defects were detected. At Allahabad, however, some defective surface drainage was noted. At Gwalior the tanks were said to be foul, the conservancy system faulty, and the surroundings insanitary. Among Native troops in 15 of 28 outbreaks no insanitary conditions existed; in the rest some overcrowding, bad drainage, foul adjoining tanks, bad water, and insanitary surroundings were complained of. In the jails bad ventilation, exposure to heat by day and want of protection from cold by night, bad water, bad drainage, and insanitary surroundings are all noted. A dual system of water-supply was condemned both at Alipore where pipe-water is used for drinking purposes and tank water for ablution, and at Champarun, where well water unfit for drinking is used for bathing purposes.

The effect of movement of attacked bodies into camp was on the whole most beneficial. Among European troops the following instances may be given. At Allahabad, where 20 cases in all occurred, the affected community was broken up into two parties, each of which moved into separate camps, and no further cases occurred. At Lucknow, where 8 cases had occurred, the community was broken up into 8 parties, each of which made one move, and no further cases occurred. At Aurangabad an affected regiment moved into camp, after which only one case occurred. At Muttra an affected regiment broke up into five parties which moved into camp. Two of them suffered no more: 2 had each one more case after movement, and 1 had two additional cases after the first move, but none after the second. At Quetta, where 70 cases occurred in one epidemic, the effect of movement was curious. The community was broken up into 4 parties in 3 of which no further cases occurred after the first move, but the disease continued to cling to the fourth party. After their first move this last-mentioned party had 11 cases; after the second move 3 cases: after the third 11; after the fourth 6; after the fifth 6; after the sixth 7; after the seventh 13; after the eighth 9; and after the ninth the disease disappeared entirely. In every other case of movement a single march sufficed to stamp out the disease. Amongst Native troops in 5 cases only were affected bodies moved into camp; in 3 of these no further cases occurred, and in 2 a single case occurred after the first move. Among jails the following instances may be cited: in seven instances only were movements made. At Hazaribagh 29 cases occurred after movement, but only one move was made, and that too late and not far enough away from the jail. At Champarun no further cases occurred after movement. At Benares 3 cases only occurred after movement, which was made only once. At Gorakhpur 2 cases occurred after the first move, 2 after the second, and none after the third. At Raipur 11 parties were formed: the first had 1 case after move; the second had 0; the third 3; the fourth 1; the fifth 2; the sixth 1; the seventh 4; the eighth, ninth, tenth, and eleventh 0. At Toungoo no case occurred after moving. At Bassein 7 parties were formed which moved into camp with the following result; the fifth, sixth, and seventh parties had no further cases; the third had 1; the second had 5; the fourth 11; and the fifth 16. The results on the whole show, therefore, the extreme benefit to be hoped for by movement. The beneficial result of movement was least pronounced in jails, but this was to be expected from the nature of the case. The movement of prisoners is attended with great difficulties, and when moved they cannot be spread over so large an area as other bodies of men for obvious reasons. Another reason for the less favourable results with jails is to be found in the delay which usually occurs before the affected bodies are moved and to their not being moved far enough away from the original site of attack. It is much to be regretted that movements in the case of prisoners are not made earlier, more frequently and far enough.

Small-pox.

Small-pox was very considerably less prevalent than it had been during the 2 previous years, the deaths throughout India (where registration is effected) numbering 80,630 against 332,904 in 1884 and 232,363 in 1883. This diminution was shared in by all the provinces with the exception of Mysore and Coorg, where the total number of deaths registered was 3,264 against 3,241 and 240 against 108 respectively. Among the remaining provinces in which a diminished ratio of mortality was recorded, this was most marked in the North-Western Provinces and Oudh, in which the ratio of 1885 was less than that of 1884 by 4·26 per 1,000. The next largest diminution was shown in Burma, viz., 1·09. In the rest it was less than 1 per 1,000, the least being 0·11 in Berar. The highest proportionate mortality was recorded in Coorg, 1·34 per 1,000, and Madras Presidency 1·2 per 1,000, and the lowest in Berar 0·09.

Fevers.

Throughout India, as a whole, fevers were somewhat more prevalent than usual if we may fairly compare the registration results of the year under review with those of the preceding five years, for whilst the approximate average mortality during 1885 was 15·84 per 1,000 that for the previous quinquennial period was 15·68. Such a comparison must, however, be taken with reservation, for we have every reason to believe that registration improves yearly in accuracy, and advancing education may also affect the registration of these particular diseases, the diagnosis of which is beset with more than ordinary difficulty for the village registrars.

Of the several provinces of India the North-Western Provinces with Oudh suffered the most severely from this cause and the Madras Presidency the least. Bombay, Central Provinces, and Punjab suffered nearly equal mortalities, and Bengal, Berar, and Assam might similarly be classified together. Comparing the fevers estimated by mortality, during the year with the average of the previous five years in individual provinces, it is seen that 7 of the 10 recorded higher death ratios than usual, the excess over the quinquennial average being greatest in Assam, Bombay, North-Western Provinces, and Bengal.

Bowel complaints.

Bowel complaints gave rise to increased mortality as compared with the two previous years, the total deaths for the three years being 293,638 in 1885, 274,234 in 1884, and 261,623 in 1883. The increase was contributed to by Bengal, Assam, Central Provinces, Berar, Madras, Bombay, Mysore, and Coorg. The excess in the case of Berar was the greatest, viz., 2·5 per 1,000 over the ratio of the preceding year, and this province also stands first in the list of provinces showing high mortality from this cause. Assam, Bombay, and the Central Provinces show the next highest excess in ratio over that of the preceding year, the excess being between 1 and 0·5 per 1,000; in the remaining provinces showing a greater mortality ratio the excess was below 0·5 per 1,000.

Injuries.

The total number of deaths from injuries returned from all provinces amounted to 83,262, a number which considerably exceeds those of the two preceding years, which were 76,583 in 1884 and 76,059 in 1883. Comparing the total number of deaths returned by the various provinces with that of the preceding year, it appears that every province, with the single exception of Mysore, contributed to the excess, though in very unequal numbers. In Mysore the deaths returned from these causes were 34 less than in 1884. Of the remaining provinces, Bengal contributed the main excess, viz., 4,282, the North-Western Provinces coming next with an excess of 1,294. In the other provinces showing an excess of deaths the excess varied from 490 in the Central Provinces to 8 in the Bombay Presidency and 5 in Coorg.

All other causes.

The number of deaths ascribed to causes other than those considered in the preceding paragraphs was 937,903 against 953,141 in 1884. All provinces, with the exception of North-Western Provinces, Punjab, and Mysore showed an increase compared with the previous year. The highest proportionate number of deaths included under this heading occurred in Berar, Madras, and Central Provinces, and the lowest in Coorg, North-Western Provinces, and Bengal.

Vaccination.

The general efficiency of the Vaccination Department may, in the first place, be estimated by the proportion of the population it has protected against small-pox. Judged by this standard, the most effective work was performed again this year, as in the preceding, in Coorg, where the ratio of successful vaccinations per 1,000 of

population was 50·79; but the statistics of this remote province must be taken with considerable reserve. Among the remaining provinces the ratios of the year under review were, on the whole, lower than those of the previous year, except in the North-Western Provinces and Oudh, Punjab and the Bombay Presidency. Of the provinces recording lower ratios the greatest deficiency was observable in Burma. Looking next to the work done upon infants, and estimating this by the results of a comparison of the actual number of children under one year of age vaccinated with an estimated birth-rate of 40 per 1,000, it appears that the best work was accomplished in Berar, where 75·7 per cent. of estimated births were successfully vaccinated. The next highest ratios were 56·5 in Punjab, 54·9 in Bombay, and 40·3 in Central Provinces, and the lowest ratios were 6·8 in Burma, 10·4 in Assam, and 10·8 in Bengal. The greatest energy was displayed by the vaccinators of the Punjab, where the average number of operations performed by each vaccinator was 2,211. Next in order come those of Berar with an average of 2,169, and Bombay with 1,854; the lowest results were recorded in Bengal, where each man performed on an average only 878 operations, and in Burma, where this number was 992. With regard to the quality of the work of the vaccinators, viewed in the light of the proportion of successful operations performed, the best results were obtained in Bengal, where 99·54 per cent. of primary operations are said to have been successful, and in the Central Provinces, Berar, and Bombay, where over 95 per cent. was successful. The lowest proportion of success was recorded in Burma, namely, 81·36 per cent. In re-vaccinations the highest proportions of success were 73·99 per cent. in Coorg, and 71·77 in Central Provinces, whilst the lowest were 25·59 in North-Western Provinces and Oudh, and 26·3 in Berar. The average cost of each successful case varied from 1 anna and 11¾ pie in Central Provinces to 9 annas and 2 pie in Burma.

Up to the present time the benefits of vaccination have not been extended throughout the province of Bengal. During the year under review the area thus protected embraced a population of 49,299,987 against 47,806,940 in 1884–85. The average number of vaccinators employed also rose to 1,463 from 1,399 in the preceding year. But the number of operations performed fell from 1,402,260 in 1884–85 to 1,284,174 in 1885–86, and the average number vaccinated by each operator from 1,002 to 878. The diminution is attributed to various causes, but principally to paucity of subjects for operation. This might have been the case in Calcutta and some other special tracts of the country, but cannot be accepted as a valid excuse for deficient work in all those places which were backward in this respect, for we find that at the rate of 40 per 1,000, the approximate birth-rate of India, the total children born during the year in the entire area brought under the operation of the Vaccination Department in Bengal numbered about 1,971,999, and that deducting from these the probable number of deaths at 120 per 1,000 the number available for vaccination was 1,735,360, but that of these only 213,735, or a little less than one-eighth, were so protected. The operations performed by vaccinators attached to dispensaries, municipalities, &c., amounted to 84,822, or only 375 per head, a very poor outturn. Adding up the work of all the establishments, therefore, the total number vaccinated in the province during the year 1885–86 numbered 1,368,996, or 119,300 less than in the preceding year. Of these, 1,361,781 were primary operations with 1,345,257 successful cases, and 7,215 were re-vaccinations followed by success in 3,388 instances. In the operations carried on by the Government and licensed vaccinators the per-centage of success was 99·54 in primary cases and 47·78 in re-vaccinations, while in those performed by the Municipal and Dispensary Agency the success was at the rate of 94·51 and 65·33 respectively. The experience of 1885–86 again shows that the partial failure of bovine lymph in tubes as compared with that taken direct from the calf or transmitted from arm to arm was due to defect in storing it. Some opposition is still offered to vaccination in certain parts of the country, but it is encouraging to find that such resistance is gradually abating. During the past year the Compulsory Vaccination Act was extended to the municipalities of Chattra, Mozufferpore, Serajgunge, and Arrah, but except in certain Sudder municipalities the provisions of the Act are not yet properly attended to.

The history of vaccination in the North-Western Provinces and Oudh during 1885–86 is satisfactory on the whole. Notwithstanding a slight decrease in the number of operators employed, the total vaccinations rose from 656,561 in 1884–85 to 697,610 in 1885–86, and the average number performed by each man from 987 to 1,053. Of the total, 671,716 were primary operations with 589,018 successful cases, and 25,894 were re-vaccinations of which only 6,626 proved successful. The provincial per-centage of success in primary cases was 87·69, and in re-vaccinations 25·59, against 87·94 and 29·23

respectively in the preceding year. The proportion of the population protected by this means was slightly in excess of the previous year, namely, 13·50 per 1,000 against 12·88. But of the infants born during the year only 282,427 were protected, or not even one-fourth of the children available for vaccination; for estimating the births at 40 per 1,000 the number of children born would be 1,764,314, and deducting from this the probable number of deaths at 332 per 1,000 there would remain 1,178,562 who ought to have been guarded against small-pox by this means. It is, therefore, evident that much still remains to be done in this important branch of sanitation. Vaccination, however, is still very backward in Oudh, as would appear by the fact that in a year of small-pox prevalence like 1885, it was in the districts of this province that the highest numbers of deaths from it were recorded. The lymph supply of the year was supplemented by points charged with calf virus collected in Lucknow, Bara Banki, Partabgurh, and Unao.

Vaccination made fair progress in the Punjab, and the prejudice of the people towards it, especially in the Native States, is gradually disappearing. During 1885–86 no changes were made in the Vaccination Department of the province excepting the reduction of the average number of vaccinators to 278 from 280 in 1884–85. But, in spite of this falling off in the number of operators, the number of vaccinations carried out rose from 578,997 in 1884–85 to 607,798 in 1885–86, and the average number operated by each vaccinator increased from 2,067 to 2,211. In addition to these, 4,668 vaccinations were performed by the medical officers and subordinates attached to dispensaries. Taking, therefore, the work of all the establishments combined, the total number of vaccinations performed during the year amounted to 612,466, with 571,774 successful cases, against 583,498, with 544,493 successful cases in the previous year. Of these, 594,367 were primary operations, and 18,099 were re-vaccinations with success at the rate of 94·74 and 48·00 per cent. respectively, the corresponding figures for the year 1884–85 being 94·76 and 41·43. The total number of infants protected against small-pox during the year was 427,734, or about 56 per cent. of the children available for vaccination if the births are estimated at 40 per 1,000; and of the general population of the province about 30 per 1,000 were successfully vaccinated.

It is unsatisfactory to record a falling off in the work of vaccination in the Central Provinces due largely to neglected duties of supervision and verification of results. The work done by the special establishment in British territories and Feudatory States amounted to 366,338 operations and by dispensary officials to 18,134, making a grand total of 384,472 operations, against 415,804 in the previous year. The average number of operations performed by each vaccinator also fell from 1,858 in 1884–85 to 1,624 in the year under report. This lessened work resulted in a fall in the proportion of persons protected by vaccination from 36·01 per 1,000 in the previous year to 32·15. Success in re-vaccinations was somewhat greater than in the previous year, but in primary operations it fell from 96·58 to 95·88 per cent. Estimating the births at 40 per 1,000, it would appear that 174,286 of 432,587 children born during the year, or 40·3 per cent. were vaccinated.

The establishment of the Vaccination Department of Berar remained unchanged throughout the year, but owing to the employment of 23 vaccinators on cholera duty for varying periods up to three months, the number of operations carried on by the special staff decreased from 93,002 in 1884–85 to 91,094 in the year under review, and the average number performed by each vaccinator fell from 2,214 to 2,169. The per-centage of success attained, however, was slightly higher, being 95·6 in primary cases and 26·3 in re-vaccinations, against 95·3 and 15·8 respectively in 1884–85. The dispensary vaccinations also decreased from 7,617 in 1884–85 to 6,560 in 1885–86. In these operations the success was at the rate of 91·4 per cent. in primary cases, and 76·6 in re-vaccinations, against 90·0 and 47·6 per cent. respectively in 1884–85. Taken all together, the total number of vaccinations performed in the province throughout the year amounted to 97,654. Of these, all but 115 were primary cases. The total number of successful cases was 93,096, including 69 re-vaccinations. Of children under one year of age, 72,860, or 69·3 per cent., were successfully vaccinated, estimating the births at 40 per 1,000. Of the total population of the province, 36 out of every 1,000 were protected. Both animal and humanised lymph were kept up throughout the year. Except in the municipalities little or no opposition is offered by the people against vaccination.

The favourable results of 1884–85 tended to show that considerable progress was being made in respect of vaccination in Lower Burma. The amount of work done during 1885–86, however, was disappointing. Notwithstanding the addition of another

vaccinator to the provincial staff, the number of operations performed during the year under review fell to 63,516 from 89,923 in the preceding year. The decrease was most marked in the districts of Hanthawaddy, Prome, Amherst, and Shwegyin, and is attributed in some cases to paucity of subjects or incompleteness of returns, and also to a certain extent to the disturbed state of the country during the latter half of the working season. The average number of persons vaccinated by each vaccinator fell from 1,427 in 1884–85 to 992 in 1885–86. Of the total operations, 59,995 were primary cases with success in 48,810 instances, or at the rate of 81·36 per cent., and 3,521 were re-vaccinations with success in 1,494 cases, or at the rate of 42·43 per cent. The corresponding ratios in the previous year were 84·36 and 65·99 per cent. The extent of protection afforded by this means to the population of the Province was only 13·46, or 6·49 per 1,000 less than in the preceding year. Dispensary vaccinations amounted in all to 1,826. This number, although small in itself, was more than double that of 1884–85. Of these, 1,718 were primary operations and 108 were re-vaccinations, the proportion of success attending them being at the rate of 72·53 and 65·74 per cent. respectively. In addition to these operations, 3,421 persons were protected by vaccination under the superintendence of Dr. Vinton. During the year under review the Vaccination Act was extended to the town of Moulmein. Animal vaccination was successfully carried out at Rangoon and Akyab, in both of which places depôts were kept up for the cultivation of lymph. The prejudice of the people against vaccination is gradually disappearing.

During the year the vaccination establishment of Assam was strengthened by the addition of 40 operators, 30 of whom were entertained by local boards alone, and, as a result of this increase, there was a corresponding rise in the number of operations from 95,282 in 1884–85 to 115,642 in 1885–86. In addition to these, 6,249 operations were carried out by tea-garden agency. The total number of vaccinations, therefore, during the year under review by all establishments combined amounted to 121,891, or 18,160 more than in the preceding year. But the average number vaccinated by each operator was small, namely 553, which shows that there is still much room for improvement in this direction. Of the above total, 121,174 were primary operations with 108,368 successful cases, or at the rate of 89·43 per cent., and 717 were re-vaccinations with success in 624 instances, or at the rate of 87·02 per cent. Vaccination in the tea plantations is dependent on the personal interest taken in it by the managers, and the results are very irregularly reported. Hence, the statistics received from this source are imperfect, and cannot be fully relied upon. No attempt is yet made in these gardens to distinguish the successful cases by ages. Omitting the tea-gardens, therefore, only 18,952 infants, or about one-fifth of the children available for vaccination during the year, were protected from small-pox throughout the province. It is satisfactory to note that the prejudice of the people against vaccination has to a great extent disappeared, and that all grades of the staff were engaged both in vaccinating and inspection work. Compulsory vaccination was carried on in the municipalities of Gauhati, Dibrugarh, and Sylhet, and in the Dibrugarh cantonment. Here, among a population of 33,255 inhabitants, 1,801 operations were performed, and of these 1,551 proved successful.

The changes in the vaccination establishment of Madras during 1885, which involved, among other things, the reduction in the average number of vaccinators employed from 776 in 1884 to 721 in 1885, resulted in a falling off in the number of operations from 776,742 in 1884 to 742,863 in the year under review; but in 1885 the average number operated on by each vaccinator rose to 1,007, and the per-centages of success to 94·7 in primary cases and 58·3 in re-vaccinations against 968, 93·0 and 54·3 respectively in 1884. Dispensary operations show progressive improvement both in quantity and quality: the total number of vaccinations rose from 22,569 to 23,616, and among these the per-centages of success increased from 79·7 in primary cases and 47·0 in re-vaccinations to 82·3 and 50·8 respectively in 1885. The total number of vaccinations performed during the year by all establishments combined was thus 766,479. Of these, 752,047 were primary cases with success in 709,412 instances and 14,432 were re-vaccinations with 8,358 successful cases. Of the children under one year of age, only 142,115 were successfully vaccinated. Seeing that the total births of the year amounted to 824,042, and that the number available for vaccination after deducting the deaths among children under one year was not less than 693,204, the proportion of infants thus protected was very small. In all 22·3 per 1,000 of the population of the Presidency were protected. Of the operations performed by special establishment, 325,648 cases, or 52·1 per cent., were inspected by the deputy inspectors. Animal vaccination was carried on in 11 circles against 7 in 1884, and

the results have been satisfactory. In the town of Madras vaccination is compulsory. Here the number of vaccinations returned was upwards of 8 per cent. in excess of the births. This is explained by children from beyond municipal limits having been brought to the town for vaccination.

During the year under review there was an accession of 23 vaccinators to the general establishment of Bombay, and the number of operations increased from 837,163, with 778,521 successful cases, in 1884–85, to 884,780, with 831,290 successful cases, in 1885–86. The number performed by each vaccinator also rose from 1,842 to 1,854. Including dispensary operations the total number performed during the year amounted to 905,892, and the total protected to 850,340 against 863,034 and 801,306 respectively in the previous year. Of the total, 831,061 were primary cases, 52,600 were re-vaccinations, and 2,231 were secondary vaccinations or immediately repeated operations in cases of failure in primary operation. In the vaccinations performed by the special establishment, the per-centage of success in primary cases was 95·83 and in re-vaccinations 67·84. These were slightly higher than the ratios of the preceding year, when they stood at 95·49 and 65·21 per cent. respectively. In dispensary operations the per-centages of success were lower than these, viz., 93·24 in primary cases and 55·72 in re-vaccinations against 90·06 and 65·11 respectively in 1884–85. In all, 32·45 out of each thousand inhabitants of the Presidency were thus protected from small-pox by special establishment against 30·39 in the previous year. Estimating the births at 40 per 1,000 of population, the number of children born during the year was 1,024,621. Deducting from this the probable number of deaths at 175 per 1,000, the number of children available for vaccination was 845,313. Of these, it would appear that 562,748 were protected by vaccination, or at the rate of 66 per cent. Throughout the Presidency vaccination was carried on from arm to arm, and with stored human lymph; but in Poona, Broach, Anklesvar, Jambusar, Rajkot, and Bandora animal lymph was also utilised, and in Bombay itself nothing but animal lymph was used for the purpose. The Compulsory Vaccination Act has been in force in Bombay and Karachi for a number of years, and appears to have proved very effective in protecting infants from small-pox.

The total number of vaccinations performed during the year 1885–86 in Coorg amounted to 10,204 against 10,598 in 1884–85. Of these, 9,558 were primary operations and 646 were re-vaccinations against 9,896 and 702 respectively in the previous year. Only 130 operations, with 99 successful cases, were carried out in dispensaries. Omitting these, the per-centage of success achieved by the provincial establishment was 90·98 in primary cases and 73·99 in re-vaccinations. About 51 per 1,000 of the population were protected by this means during the year. The Vaccination Act of 1880 is in force in the four municipal towns of the province, and seems to work well.

Sanitary Works—Military.

In the Report for 1884 it was noted that no information had been received up to date of its publication regarding the details of Military sanitary works executed or in progress. This information has since been received and is given in the following paragraphs:—

Accommodation for Troops.

At Lucknow the substitution of permanent for temporary barracks for two battalions of British Infantry has now been completed. The last set of six buildings in hand have been carried out for the estimated cost.

At Darjeeling complete accommodation for a mountain battery has been in progress. It will take another year to complete.

At Quetta barracks, with subsidiary buildings for a battalion of British Infantry, have been in progress, and are finished at the estimated cost. Their auxiliary accommodation has still to be carried out.

At Peshin the advanced position in Beluchistan, a defensible post with complete accommodation for half a regiment of Native infantry and a detachment of cavalry, including provision for officers' quarters, hospitals, commissariat, transport, and all the accessories to make the position completely self-contained and independent, has been under construction; about one-fifth of it remaining to be finished.

At Cherat hut accommodation has been begun for a cantonment for a battalion of British infantry, with the necessary accessories. It is desired to carry out this work as economically as possible, and as the materials for building are scarce and

carriage expensive, experiments to arrive at the most economical style of building, roofing, &c. are being made with the smaller buildings before proceeding rapidly with the general project.

At Duki, on the Beluchistan frontier, the collection of materials was begun for a post similar to that at Peshin, but it was afterwards suspended, owing to a question of a change of site. That change has since been ordered, and the post is to be at Sinjawi instead of at Duki, and most of the materials collected will be moved to the new site.

Besides the provision of quarters for officers, forming part of the general project for the post at Peshin, the erection of officers' quarters has been in progress at Quetta.

Station hospitals of British troops, which were under construction at Rawal Pindi and Agra, have been finished.

The Station Hospital at Morar was in progress, and more than half had been carried out.

Improvement and Renewals of Buildings.

This is a most important section of our work, involving the renewal of old temporary buildings as permanent structures, or their improvements in some special defective feature, such as the substitution of permanent tiled roofing for thatch and the like. The outlay on this section of the works has been one-fifth of the whole outlay, and the cost of the work completed during the year was Rs. 3,61,845 against estimates aggregating Rs. 3,79,595.

By far the most important work under this head is the restoration of the old accommodation of the Cantonment of Peshawar, in part of the completion of the full accommodation wanted there. The project is as follows:

There were 126 buildings, altogether, extant for the accommodation of a battalion of British infantry, a regiment of cavalry, artillery, and hospital purposes.

The artillery to be sheltered has been reduced to one battery, and a second battalion of infantry has to be housed instead of the regiment of cavalry.

Of the existing buildings 26 have been condemned and are to be dismantled, and 100 are to be retained; besides which, 14 new buildings are required.

The most important of the other improvements was the re-roofing in a permanent style, chiefly with double Allahabad tiles in the plains and sheet iron in the hills, buildings which had been roofed with thatch or shingle. This was being carried out in 31 buildings at Meerut and elsewhere.

The British Infantry Canteen, Lucknow, Sergeants' Mess, Lucknow, the canteen at Bareilly, and the Native Infantry Hospital at Fyzabad were re-roofed and improved, and a barrack at Meerut, which have been burnt down, was being rebuilt.

The most important cantonment wants were the water-supplies at Jubbulpore and at Chakrata.

The former was a work undertaken by the Provincial Public Works Department for an estimate of Rs. 30,300, to which this department contributed Rs. 24,000. About four-fifths of the work was done.

The latter, the Chakrata water-supply, is a project which consists of several parts. Parts i, ii, and iii, bringing the water-supply from one of the streams as far as the parade-ground, with relief tanks, and estimated to cost Rs. 93,624, has been sanctioned, and in progress, and is two-thirds carried out. The rate of progress depended on the arrival of the water-pipes from England. These were landed just as the year was closing.

Part iv. A reservoir (at Morrow's neck), estimated at Rs. 24,932, has also been sanctioned and begun.

The extension of the Peshawar water-supply to the Sudder Bazar and railway station was begun, and the roads and drains in Quetta were in progress.

I may remark that a proper water-supply for Quetta is a prominent want.

The outlay on minor works has been slightly in excess of the amount originally provided, but much less than the maximum to which that provision may be raised, viz., the average of the last five years. This reduction from the old average outlay entails some difficulty and trouble, but the result aimed at is being steadily gained, viz., the exclusion from minor works of items that should be charged as repairs, or should appertain to some major work. One important change has been instituted. A chief difficulty in dealing with minor works lay in disposing of the demands of medical officers. By requiring, when general officers desire it, that these shall be referred to the head of the department, and by practically assigning to him a grant for such

purposes, these medical demands, heretofore overwhelming and causing great anxiety to general officers, have been reduced to practicable limits and the allotments to general officers are assigned to wants of which they personally judge the necessity.

During the year 1885–86 Rs. 57,39,620 were spent on military works as shown below :—

	Rs.	a.	p.
Original Works	22,45,367	4	11
Repairs	15,49,461	5	1
Establishment	15,21,012	12	0
Tools and Plant	51,967	5	5
Suspense	26,320	15	6
Barrack Department	4,49,000	15	7
Total	*57,90,488	11	6

Certain details regarding these works are given below :—

Accommodation for Troops.

At Darjeeling.—Complete accommodation for a mountain battery has been almost finished, a few subsidiary buildings only remaining to be built. The barracks have since been in occupation by troops.

At Quetta.—A small outlay has been incurred in completing the subsidiary buildings for the first battalion of British infantry, and the auxiliary accommodation for this battalion is in progress. Materials to the extent of about a lakh of rupees have been collected for the barracks for a second battalion of British infantry. Three barracks, with their subsidiary buildings for the single men of a mountain battery, were commenced and completed for occupation by winter.

At Fyzabad.—The construction of three new barracks for Royal Artillery, in consequence of the increase in the garrison at that station, has been begun.

At Meerut and Muttra.—Materials were collected for the commencement of buildings for an additional squadron of British cavalry at each station.

At Cherat.—Owing to want of funds little progress was made on the hut accommodation which had been begun the year before for a battalion of British infantry.

At Quetta.—Arrangements have been made to collect materials for the construction of buildings for a station hospital.

At Lucknow.—The military prison in the Kaisarbagh has, owing to its distance (some 2½ miles) from the cantonment, its unhealthy situation, and the insufficient accommodation provided in it, been removed to the old cavalry hospital building in the cantonment, which has been suitably adapted for the purpose.

At Meerut.—In the British infantry lines, to replace the old temporary building which had been condemned, a new quarter-guard has been provided and the existing cells remodelled, a part being converted into a lock-up, &c.

Improvement and Renewals of Buildings.

Two important roads have been in progress, viz., the high level Bolan Pass Road, and the road to connect Cherat *viâ Chapri* with *Pubbi*, the nearest station on the Peshawar Railway..

The earth-work on the Cherat Road has been completed, and metalling partly collected. The estimate amounts to 2½ lakhs, and against this Rs. 94,525 has been spent altogether, of which Rs. 76,279 was during the year.

As regards the Bolan Road, the formation was completed in 1884–85, and during the year under report the first coat of metalling was completed between Rindli and Quetta, including the *Dasht*, which was previously impassable during wet weather, while the absence of stone and water rendered the task of metalling a difficult one. Six major bridges were completed and three nearly finished. The ironwork for the Kundilani Bridge, 180 feet span, has been designed and prepared in England. Its erection will be commenced during the working season of 1886–87. The approaches on both sides have been completed. At Bibinani sufficiently good footing has been found for an

* Excluding Rs. 50,868–8 expended in England.

experimental pier, and its foundations were finished. The minor culverts and bridges were finished, with the exception of one or two near Quetta.

In addition to these, 10 causeways have been constructed.

Besides the above, camping grounds were levelled and marked out at the different stages on the road.

Owing to the orders of Government to suspend all optional expenditure little was done under the head of cantonment wants, and the works on the Chakrata water-supply and the construction of cantonment roads at Quetta were partly suspended, only such expenditure on the former being permitted as would secure the existing work against damage; while, in the case of the latter, progress was limited to the metalling of such roads as urgently needed it.

Civil Sanitary Works.

In the municipalities of Bengal, out of a total income of Rs. 30,41,223, the sum of Rs. 15,21,997, or nearly 50 per cent., was spent on sanitary works. But this expenditure was very unequally distributed. In several towns the outlay on sanitation was only nominal, and the attention of the authorities concerned has been drawn to it. Some of the important sanitary works executed or undertaken during the year under review were as follows:—In Burdwan a further sum of Rs. 39,985 was expended to complete the waterworks of the city, and Rs. 35,000 were granted by Government for improving the water-supply in certain parts of the district by excavating new tanks and deepening those that were old and silted up. Arrangements were being made for a good water-supply for the portion of the Moorshedabad city remote from the river. The question of permitting house connexions with water-pipes at Darjeeling was under consideration. The waterworks at Bhagalpur were taken in hand and were progressing. A scheme for the water-supply of Cuttack was devised, and in Puri an experimental water-supply project was in hand. In Midnapore Rs. 20,283 were spent in improving the villages constituting Khas Mehals or Government estates, and Rs. 73,800 were expended in completing the Supai drainage scheme. In Ranaghat 22 tanks were re-excavated and the silted-up mouth of the Choorny River was opened, by which good water has been secured for the villages lying on its banks. Levels were taken for carrying out the Ghatal drainage scheme. The drainage of the Midnapore town was greatly improved. In Moorshedabad levels were taken for introducing a regular system of drainage in the Baluchar ward, and arrangements were being made for improving the Bistopore *bhil*. Drainage works for the Beauleah town were being actively carried out. In Bhagalpur the Soojaganj drainage scheme has been completed. In Birbhum some steps were taken to improve the sanitary condition of villages.

Very little seems to have been achieved in village sanitation in the North-Western Provinces and Oudh during the year; but it is noted "that some progress is being made; officers on tour do what they can to promote sanitation, and some change may in time be effected by example and experience in the habits of the people." All the municipalities spent some portion of their income on sanitary improvements, which consisted generally in constructing or repairing wells, tanks, drains, latrines, and slaughter-houses, paving roads, levelling excavations, &c. Of these, the following were important:—At Dehra the municipality has been permitted to raise a loan of Rs. 12,000 for improving the water-supply, and designs for it have been prepared. At Mussoorie the Khatta-pani reservoirs and pipes were improved. At Saharanpur Rs. 25,000 have been borrowed for the completion of the city drainage system. At Roorkee Rs. 12,491 were spent chiefly in constructing a permanent main drain to the south of the city. At Meerut Rs. 16,593 were expended mainly on the construction of two drainage ways. At Lucknow Rs. 20,218 were expended in making stone and brick drains, filling up ditches, &c. At Fyzabad a large outlay was incurred on a new drainage system consisting of a main channel and 11 drainage ways. At Cawnpore Rs. 35,202 were laid out chiefly on drainage and filling up an old tank. At Gorakhpur and Ghazipur also a good deal was spent on drainage.

The principal sanitary works executed or undertaken in the Punjab during 1885 were as follows:—The drainage works of the Dera Ghazi Khan cantonments were completed. A scheme for draining the city of Gujranwala has been approved by the Government. The Simla sewerage works made considerable progress during the year. At Amritsar the outfall channel and the main cut with branch No. 1 were completed; the city ditch was partially filled up and a large area of land was reclaimed thereby, and a large low-lying dense garden, which was a source of danger to the health of the

thickly populated part of the city, has been converted into suitable sites for human habitation. Certain works in connexion with the drainage of the Lahore Female Penitentiary were also executed. Projects for the water-supply of the city of Peshawar and Edwardesabad cantonment were under preparation, and the Rawalpindi water-supply scheme has been sanctioned by the Local Government. Besides these, many minor sanitary works, such as construction of latrines, roads, drains, bridges, &c., were also carried out in the municipal towns. The total expenditure on sanitary works incurred by the municipalities of the Province was Rs. 9,38,988.

In 1885 the sale of manure realised upwards of Rs. 84,000 against Rs. 78,000 in the preceding year.

No sanitary works of any magnitude were undertaken or executed in the Central Provinces during the year. The district reports show that attention was paid in some places to the improvement of drainage, water-supply, and conservancy. All the municipalities devoted a portion of their income to their sanitary requirements, but the proportion in which this was done varied greatly, from 15·63 per cent. in Bilaspur to 61·12 in Damoh. Village sanitation is still in its infancy. It is satisfactory, however, to find that it is receiving its due share of attention. In all 230 new wells were constructed in the villages throughout these provinces, and the Divisional Commissioners have been called upon to report on the working of certain simple rules issued for the improvement of villages under the Central Provinces Land Revenue Act.

The important sanitary works carried out during the year in Berar were the completion of the waterworks at the towns of Amraoti and Khamgaon. Most of the tanks and anicuts (weirs), which were stated in the last Report to be in hand, were either completed by the Public Works Department or were approaching completion. In most of the municipalities considerable extensions and improvements were effected in their drainage systems, and the conservancy arrangements were in efficient order. In all Rs. 62,904-4-2, or 36 per cent. of their income, were spent by the different municipalities on sanitary improvements. With regard to sanitation in the Province beyond municipal limits, the amount allotted by the District Local Fund Boards during the year under review was Rs. 91,764-9-6, and the amount actually expended was Rs. 90,711-3-10. Of the total 36·5 per cent. were spent on conservancy, 12·9 on drainage, 17·5 on water-supply, and the rest on other sanitary improvements.

There is very little to record under the head of civil sanitary works in Lower Burma. The only works of any importance were those carried out in connexion with the Prome water-supply. The Rangoon drainage scheme noticed in last annual Report was still under consideration. A commencement was made to reclaim some low-lying land to the east of the Rangoon town. Altogether Rs. 66,866 were spent by the Public Works Department on sanitary works during the year. The Chief Commissioner has drawn the attention of the district officers to the objectionable and dangerous state of cess-pits, especially in thickly-peopled towns.

The principal sanitary work of the year in Assam was the water-supply scheme of Gauhati, which was nearly completed at the close of 1885. Great improvements were made in the sanitary condition of Dibrugarh. Besides these, sanitary works of a minor nature were also carried out in various parts of the Province. The towns, unions, stations, and municipalities spent a sum of Rs. 89,424-14-8 on sanitation, including medical relief, against Rs. 69,177-6-2 in the preceding year. Many improvements were also effected in the tea-gardens of Cachar in respect of barracks, water, food supplies, and clothing.

No new sanitary work of any importance was undertaken during the year in Madras Presidency, excepting the improvements carried out in the water-supply of the town of Cuddalore. Here water is now brought in open channels and stored in reservoirs with filter beds. In municipalities conservancy arrangements were duly attended to, and many minor improvements were effected in the way of constructing and repairing markets, slaughter-houses, latrines, dustbins, drains, &c., and improving town sites and sources of water-supply. Out of the total income of the municipalities, excluding Madras town, Rs. 5,91,071, or 31·4 per cent., were allotted for sanitary purposes, but of this only Rs. 4,21,768 were expended during the nine months ended December 1885. It is very desirable that the municipalities should pay more attention to this matter, and utilise the whole of these annual grants to the purposes for which they are intended. In 1884–85 Rs. 6,54,536 were sanctioned for sanitary improvements, but of this only Rs. 5,63,816 were actually expended, and the balance, Rs. 90,720, allowed to lapse. Under the Madras Local Boards Act, introduced in April 1885,

each district has been constituted a board, whose duty with regard to sanitation is to carry out the improvement of village sites and water-supply, the sanitary arrangements during fairs and festivals, the scavenging of small towns and large villages, the construction and repair of markets, slaughter-houses, latrines, dustbins, and drains, and other measures calculated to promote the health, comfort, and convenience of the people. The amount allotted for these purposes in 1885–86 was Rs. 3,41,504, but from April to December 1885 only Rs. 1,95,660 were expended. As in the municipalities, the Local Fund Boards did not spend the whole sum available for sanitary improvements in the preceding year.

Under the head of sanitary works there is nothing very important to record in Bombay. In the different municipalities of the Presidency a portion of their income was devoted to cleansing towns and constructing or repairing works conducive to public health and utility. Of these, the following may be noted:—The waterworks were completed at Roha and Karachi. At Ahmedabad Rs. 5,401 were spent on latrines, urinals, and gutters. At Viramgaum and Nadiad Rs. 16,120 were laid out on roads. At Surat Rs. 18,567 were spent on new works, including latrines. At Ahmednagar Rs. 13,681 were expended on new works, consisting of aqueducts, latrines, dustbins, and drains. At Poona Rs. 73,726 were spent in constructing a market, certain public latrines and drains, and carrying out certain works in connexion with water-supply. At Sirur arrangements were made to bring water from the river at a cost of Rs. 8,796. At Sholapur an outlay of Rs. 9,166 was incurred on new drains and latrines, and waterworks. In Ratnagiri Rs. 8,379 were spent in substituting iron pipes for masonry channel, by which water is brought to the city. Besides these, several other municipalities also carried out sanitary works of like nature at a small cost. During 1885–86 the total income of the municipalities was Rs. 30,70,624, and out of this Rs. 6,83,668 were spent on conservancy arrangements. Considerable sums were spent by the Local Fund Circles on sanitary works, consisting chiefly of improvement in water-supply by constructing new wells and tanks or repairing old ones. It is satisfactory to notice that the subject of village sanitation is now engaging the attention of the Bombay Government. Since the close of 1885 a resolution has been issued by that Government, setting forth the principles on which it is proposed to legislate with a view to carry out in an efficient manner the sanitation and conservancy of villages in that Presidency.

There is very little to record under the head of sanitary works in Coorg. In all Rs. 3,037 were spent on the municipalities in improving drainage, repairing roads, constructing latrines, and other works of a minor nature.

General Remarks.

Absence of cholera at the Haj of 1885.

It is very satisfactory to record a second year of the absence of cholera and other epidemic disease from the Haj pilgrims to Mecca. In the Report for 1884 the complete immunity experienced by them from cholera was noted and ascribed to the greater sanitary precautions taken against disease causes in general, such as special attention to conservancy, surface cleanliness, and a pure water-supply. The immunity of the year under report was doubtless in part due to this as well as to sustained efforts in the following pilgrimage season, though there is reason to fear that the later efforts were not so strenuous as those of 1884. As the Haj in the year under report fell on a Friday an unusually large attendance was expected, and the expectation appears to have been fully realised. That there should have occurred no unusual sickness under these circumstances is all the more gratifying. The sanitary condition of Mecca and Moona, which in the previous year had been exceptionally good, was not, however, in 1885 in so satisfactory a state. The water-supply is usually obtained at these places from the stagnant water collected in tanks during the rainy season. This water was usually a source of disease, and in 1884 to obviate it the tanks were drained before the Haj season, in consequence of which the pilgrims were compelled to buy good fresh water brought from Zobeida aqueduct. During 1885, in consequence of drought, the tanks were not filled by rain water, but before the pilgrim season they appear to have been filled by water led into them from the aqueduct. This water, though probably better than it would have been had rain collected water stagnated there, was not, however, of good quality. It was said by Vice-Consul Ata Mahomed, who accompanied the pilgrims, to have been of so irritating a nature as to effect almost all who drank of it with sore throat. The number of

pilgrims was estimated at 180,000; but, notwithstanding this general increase, the numbers from India were fewer than in former years, which is attributed to the hardships entailed upon them by quarantine rules and the train of evils following these measures.

Scientific Memoirs.

The second volume of "Scientific Memoirs" published as an accompaniment to this report contains several papers of interest, and fully realises the anticipation formed of the desirability of opening a convenient channel for the publication of the results of observations or researches on biological subjects for the investigation of many of which the special conditions to be found in India are peculiarly favourable. There is indeed scarcely any portion of India in which special problems of great interest do not await investigation, and there is every hope that the publication of these memoirs as they become better known will stimulate medical officers scattered over this vast continent to undertake their study in their leisure time. The volume just published contains the following articles:—

1. On the effects sometimes following injection of choleraic comma bacilli into the subcutaneous tissues in guinea-pigs, by Surgeon-Major D. D. Cunningham; 2. On the Life History of a new Æcidium on Strobilanthes Dalhousianus, Clarke, by Surgeon-Major A. Barclay; 3. On Æcidium Urticæ, Schum, var Himalayense, by Surgeon-Major A. Barclay; 4. On the Phenomenon of gaseous evolution from the flowers of Ottelia Alismoides, by Surgeon-Major D. D. Cunningham; 5. On the Fertilisation of Ficus hispida—a problem in Vegetable Physiology, by Surgeon-Major G. King; and 6. Note on Eggs of Distoma (Bilharzia) hæmatobium found in Transport Cattle, by Surgeon-Major G. Bomford.

Results obtained in the Biological Laboratory.

The most interesting results obtained in the Biological Laboratory during the course of the past year, so far as the question of cholera is concerned, were those in a series of experiments on the subcutaneous inoculation of the so-called "Choleraic Comma Bacilli" into the bodies of guinea-pigs. They clearly showed that such inoculations are not unattended by serious risks, as in a considerable proportion of the cases they were followed by fatal results attended with such uniform and characteristic symptoms as could leave no reasonable doubt that a specific pathogenic influence had been at work. An excessive multiplication of the bacilli had occurred, especially along the course of the lymphatic channels. They were present in vast numbers in the subcutaneous lymphatic spaces extending from the site of injection and which were full of a sanguinio-serous effusion diffused over varying but always considerable areas. The bacilli were not, however, confined to the subcutaneous lymphatic system but were present in multitudes in the peculiar adhesive secretion lining the peritoneal cavity. None could be recognised in specimens of blood, but the result of cultivations appeared to show that they were present in it in limited numbers as pure crops of commas were invariably developed. One very conspicuous and important feature in all the cases was the presence of large numbers of the bacilli within the intestinal canal. In some cases the numbers here were excessive. In all their presence was accompanied by softening and a tendency to desquamation of the epithelium, and in one case this had advanced so far as to result in absolute denudation of the entire mucous membrane throughout the whole course of the canal. Cultivations clearly showed that the bacilli were specifically identical with the true choleraic commas and differed from the curved bacilli normal to the intestinal tract in guinea-pigs. Although careful search was made, no bacilli could be detected in the substance of the walls of the canal, and certain phenomena appeared to indicate that their transfer from the peritoneal cavity to the interior of the gut was affected, not by general diffusion, but by the agency of "carrier-corpuscles."

The phenomena present in these cases does not warrant the definite conclusion that they were of a truly choleraic nature. They, however, clearly show one thing, for whether the disease were choleraic or no, there can be absolutely no doubt that choleraic commas were present within the intestinal canal in large numbers, and, therefore, that their presence there in any case cannot be taken as conclusive evidence that this was the site of primary invasion of the system by the parasite. But for full details recourse must be had to Dr. Cunningham's paper in the Scientific Memoirs above alluded to.

Venereal disease.

A special feature in the sanitary history of the year has been the thorough consideration given to the question of the utility of preventive measures in checking the prevalence of venereal disease in the British Army of India. It had come

to be very generally questioned and, as the machinery employed to combat these diseases is costly, it became imperatively necessary to come to some definite conclusion as to whether preventive measures were of any use; and, if so, whether the benefits derived from them were commensurate with the cost of their maintenance. The facts showed that there could be no doubt whatever that preventive measures were of use and to a degree sufficient to warrant the amount expended upon them so far as the purely financial aspect of so complex a question could be determined, at any rate in this office. A careful review of the whole question showed that much of the increasing venereal prevalence of late years was due to the greater youth of the army since the introduction of the short service system of enlistment, though doubtless also much may be due to relaxed efforts in enforcing the rules of the Cantonment Act for the prevention of venereal disease. So much of the prevalence of the disease as may be directly due to the results of the short service system of enlistment is unavoidable, but all the rest is capable of being removed. The experimental closure of certain lock hospitals in selected stations throughout India during 1885 and 1886, showed clearly, that although venereal disease on the whole, both in protected and unprotected stations, prevails more now than it did ten years ago (due mainly to special causes—the result of short service enlistment), but for preventive measures they would have prevailed yet more extensively and indeed beyond all limits compatible with the due efficiency of the British Army of India. The facts disclosed by the experiment were so conclusive that the Government of India have ordered the immediate re-opening of all the lock hospitals which were tentatively closed, and the maintenance of restrictive measures in all their former fulness. As the subject is one of great importance, a full note on it has been added as an appendix.

NOTE ON THE EXPERIMENTAL CLOSURE OF SEVERAL LOCK HOSPITALS DURING 1885.

By Surgeon-Major A. Barclay, M.B.

The question of the efficacy of protective measures against an undue prevalence of venereal disease in the European Army of India, and the desirability or not, therefore, of continuing to enforce them having been fully considered during the present year (1886), it will be useful to place the facts and arguments brought to bear upon the discussion on record in this volume. The utility of any special measures against these diseases had come of late years to be gravely doubted, and this especially because, in spite of the continued operation of certain laws enacted in 1864 to suppress, and, if possible, to extirpate them in the Army, these diseases have given rise to progressively higher admission-rates of late years. The rise in the admission-rates, especially since 1877, led many to believe that the futility of protective measures was fully established, and that it was desirable at once to put an end to them as involving a useless expenditure of public money. Before, however, finally condemning the system, it was resolved early in 1885 first to view the effect of the measures in operation in the light of an experiment to be made by closing certain selected lock hospitals throughout India during one year, and comparing the prevalence of venereal disease among the troops quartered at these cantonments with that existing in them before the experiment and with the venereal prevalence exhibited in stations still protected. The results of this experiment were submitted during 1886, and the debated question was thus capable of being dealt with on wider bases.

Before, however, considering the actual results of the experimental closure of the several lock hospitals above alluded to, it was necessary to ascertain, if possible, whether any general causes may have led to the extraordinary increase of these diseases during recent years, apart from any imperfections or impotency in the means hitherto taken to repress them. For the Army of India, as a whole, the admission-rates per 1,000 for all classes of venereal disease are available since 1871, and they are as follows:—

1871	196·8	1876	189·9	1881	260·5
1872	179·0	1877	208·5	1882	265·2
1873	166·7	1878	271·3	1883	270·3
1874	192·7	1879	234·8	1884	293·9
1875	205·1	1880	249·7	1885	342·7

These results show forcibly the great rise which has taken place of late years, commencing about 1877. It was, therefore, quite evident that some new cause or causes had come into operation to account for these progressing ratios; for, even assuming that the means taken to repress these diseases were entirely powerless, it could scarcely be contended that they actually fostered the disease, and that especially since 1877. In endeavouring to discover these causes, it soon became apparent that they were, for the most part, results of the introduction of the short service system of enlistment, which, although introduced in England in 1870, did not produce any well marked influence upon the Army of India until some five or six years later. This new system produced the following changes in the Army, which are of special consequence in this connection, namely (*a*) an increase in the proportion of young men under 24 years of age; (*b*) a diminution in the proportion of married men in the rank and file; and (*c*) an increase in the number of young unacclimatised and inexperienced soldiers annually brought to India. But in addition to these results, whose influence upon the prevalence of venereal disease will be shown below to have been very great, a fourth important factor is to be found in the more frequent movement of troops of late years, not only on account of continued field operations, but also on account of the assembly of large and important durbars and camps of exercise. The influence of each of these four causes will now be traced.

The extent to which the proportion of young men in the army under 24 years of age has been raised is shown by the following ratios:—

	per cent.		per cent.		per cent.
1871	39·8	1876	32·9	1881	42·5
1872	39·2	1877	33·5	1882	40·6
1873	38·7	1878	35·2	1883	41·3
1874	37·5	1879	39·1	1884	44·9
1875	35·5	1880	40·7	1885	47·8

These ratios represent the percentages of men under 24 years of age in the whole Army of India. The rise since 1877 is well marked, and the ratios would show that it is still progressing. That this is a potent factor in causing an increased prevalence of venereal disease will scarcely be denied, though it would be difficult with the data available to demonstrate it by actual statistics.

The diminished proportion of married men in the rank and file since 1877 is very striking. These proportions since 1871 are set forth below:—

	per cent.		per cent.		per cent.
1871	11·19	1876	10·37	1881	6·36
1872	11·32	1877	9·70	1882	5·94
1873	11·26	1878	—	1883	5·43
1874	11·10	1879	7·59	1884	5·20
1875	10·80	1880	6·63	1885	5·05

The influence of this factor in exalting admission-ratios will be evident from the following statements taken from previous annual sanitary reports. In 1867, while 0·40 per cent. of married men in the Bengal Army were admitted into hospital for venereal disease, 16·94 per cent. of unmarried men were admitted the same year. In 1872 these ratios for the whole Army of India were, for married men 0·41 and for unmarried men 18·70 per cent. The ratios of intervening years are given in the following table:—

Year.	Per-centage of Admissions for Venereal Disease among the		Days spent in Hospital from all Diseases by the	
	Married.	Unmarried.	Married.	Unmarried.
1867	0·40	16·94	9·0	18·0
1868	0·45	19·99	8·0	18·5
1869	0·18	20·64	9·5	22·0
1870	0·32	20·62	8·9	22·9
1871*	0·58	20·92	9·0	21·3
1872*	0·11	18·70	?	?

* These years for the Army of India; the remaining years for the Bengal Army only.

Similar ratios for succeeding years are unfortunately not available, but as those given are fairly uniform, they may be taken as persistent, and on this assumption their significance becomes very striking when viewed in the following light. In 1872 among every 10,000 men there were 1,132 married and 8,868 unmarried. Of the married men 5 went into hospital for venereal disease and of the unmarried 1,658. In 1885 there were only 505 married men per 10,000 and 9,495 unmarried men; and whilst 2 married men were admitted for venereal disease, 1,776 unmarried men were admitted the same year. Thus in 1885 married men showed 3 admissions per 10,000 less than in 1872 and unmarried men 118 per 10,000 more than in 1872. In 1885 married and unmarried together contributed 115 per 10,000 more admissions than in 1872; that is, the effect of the diminished married proportion in the Army was the addition of 11·5 venereal admissions in each thousand of strength.

The approximate average number of days spent in hospital by the unmarried for all diseases, taken together as set forth in the above table, is 20·5, and assuming that on an average the same number of days were spent in hospital by each man admitted for venereal disease (and this number is probably greatly exceeded), the total number of days of inefficiency due to this increased admission-rate resulting from a diminished married proportion was, other things being equal, $115 \times 20{\cdot}5$ or 2,357·5 days per 10,000 men more in 1885 than in 1872. Taking the strength of the European Army of India at 50,000 men roughly this would mean an absolute increase of 11,787·5 days of inefficiency in 1885 over that of 1872.

The actual effect of this cause is not susceptible of proof by statistics, but the following ratios representing percentages of the army show the increase which has taken place in the number of inexperienced young soldiers *annually* brought to India, and as the overwhelming majority of these men are unaccustomed to the usages of the country, it cannot be doubted that they fall an easy prey to the lowest prostitutes of the country among whom venereal disease is well known to be rife:—

	per cent.		per cent.		per cent.
1870–71	15·5	1875–76	13·1	1880–81	22·4
1871–72	15·5	1876–77	14·3	1881–82	17·3
1872–73	14·1	1877–78	16·1	1882–83	17·6
1873–74	14·6	1878–79	22·2	1883–84	22·8
1874–75	13·4	1879–80	22·3	1884–85	20·7

It is not easy to prove by exact figures the effect of the more frequent movement of troops during late years on account of continued field operations, durbars, and camps of exercise, but statistics afford some general indication of the fact that troops in movement within our own territories act as accumulators of venereal disease. After they have crossed the frontier, in the case of field operations, the subsequent prevalence will depend much upon the nature of the country occupied and upon the amount of hostility displayed by its inhabitants. In Afghanistan, for example, the troops could not become affected to any large extent with venereal disease owing to the extreme hostility of the people. As a matter of fact, during 1879, while the admission-rate for venereal disease in troops within India was 268·3 per 1,000, it was only 59·8 for the troops on active service. But in Burma, where these conditions do not exist to the same extent, we hear that the prevalence of venereal disease has been a source of anxiety, though no statistics have as yet been received. Some indication of the effect of movement may be obtained by comparing the prevalence of the disease during the cold weather months, when relief movements within our territories are in active operation with the prevalence during the hot weather months when the troops are, as a rule, stationary. Unfortunately a division of the year in this way makes it impossible to utilise the statistical data given in the appendices of these reports, which are all calculated for the calendar year; but I have taken the total number of admissions during the half year from April to September (hot season) and compared them with the admissions during the other half-year from October to March (cold season) in the following table. The comparison between the hot and cold weather prevalence would, however, I think, have been fairer had I taken the figures of only four months (November to February) on the one hand and the remaining eight months on the other, for by far the greatest number of relief movements have already been accomplished in the former period; but in order to avoid any accusation of partiality in manipulating these figures, I have taken six months on either side. They relate only to the Bengal Army.

Venereal Admissions: actual numbers.

	Hot weather April—September.	Cold weather October—March.		Hot weather April—September.	Cold weather October—March.
1871–72 -	3,356	4,152	1879–80 -	4,181	4,543
1872–73 -	3,287	3,018	1880–81 -	3,909	6,059
1873–74 -	3,128	3,464	1881–82 -	4,624	4,599
1874–75 -	3,509	4,307	1882–83 -	4,616	5,003
1875–76 -	3,608	4,041	1883–84 -	4,475	5,254
1876–77 -	3,263	3,593	1884–85 -	4,942	5,455
1877–78 -	3,322	4,761			
1878–79 -	4,987	5,015	Total -	55,207	63,264

Thus for the whole period taken since 1871, the total number of admissions during the cold season, or season of relief movements, exceeded the total during the hot season by 8,057 or by 575·5 on an average each year. This difference is certainly small when the whole strength of the Bengal European Army is taken into consideration, but it should be borne in mind that I have not been able to confine myself to the statistics of troops which have actually moved within our own territories, but have had to include all admissions indiscriminately, whether occurring in India or beyond its frontier, in regiments which have not moved as well as in those which have. The figures therefore do not pretend to convey any accurate measure of the amount of increased venereal prevalence due to movement, but merely to indicate that such movements do exert a decided influence in increasing the disease. The table shows that in two years only, namely, 1872–73 and 1881–82, the total admissions during the cold season were fewer than during the hot weather, but in the twelve remaining years they were always greater during the cold season. During the two exceptional years there were probably exceptional causes for the want of conformity displayed, but I have not been able to trace them. Having thus established the fact that ordinary annual movements cause an increase in the disease prevalence, we will now proceed to show that in times of extraordinary movements, so long as they are within our own territories, we have had as a rule well marked increase in admission-rates for venereal complaints. During the latter part of 1875 the large camp of exercise formed at Delhi at the time of His Royal Highness the Prince of Wales' visit to India, caused an unusual movement of troops, and in that year an increased prevalence of venereal disease took place. During 1878 very large movements of troops occurred in connection with the impending war in Afghanistan, and in that year the disease prevalence took a remarkable upward bound. The rise for the whole army of India was mainly due to the rise in the Bengal Army, and this Army was mainly, though not solely, affected by these preliminary movements. During 1879 and 1880 a very large proportion of the Bengal Army was in Afghanistan, where, as already explained, the disease could not readily be acquired, and in consequence we find the prevalence ratio considerably diminished. But in the Madras and Bombay Armies, which made considerable movements within our own territories to garrison places vacated by the Bengal Army, the disease was increasing in prevalence. During 1881 the disease prevalence for the Army of India still continued to increase, due mainly to the increased prevalence in the Bengal Army now in great movement within our own territories upon the cessation of hostilities in Afghanistan and the return of troops to Indian cantonments. The Bombay Army was also involved, though to a less extent in these return movements, and in that army likewise the disease prevalence was high; but in the Madras Army, which was the least affected, the disease was less prevalent than in the other two armies. From this time venereal disease prevailed to a large extent, and continued to increase yearly, probably because the general causes enumerated in paragraph 2 began to act with greater intensity as time went on, but also because during these years the troops were in continuously active movement, due to the Egyptian war in 1882, to the large darbar held at Rawal Pindi during 1885, to the large camp of exercise at Delhi in 1885–86, and finally to the movement of troops in connection with the Burma war. The maximum prevalence reached in 1885 with an abruptness comparable with that of 1878 was due especially to the increased ratios which prevailed in the Bengal and Madras Armies. But this great increase was probably due more to the experimental closure of several lock hospitals, especially in the Bengal Presidency, than to troop

movements, though these also, in connection with the Burma war, no doubt, aided.

These reasons appear sufficient to explain to a very large extent the marked increase in the prevalence of venereal disease of late years, in spite of the continuance of protective measures. There can, however, be little doubt that, as has already been mentioned, the efforts made to enforce them have lately year by year been relaxed, chiefly because the belief in their powerlessness continued to gain ground; but the facts show that the increase in these diseases might have been expected, and that as new and powerful causes came into operation, greater instead of feebler exertions were needed to control them. It will also be shown in a following paragraph that the system of protection provided is not powerless to effect much good.

We may now proceed to analyse the results afforded by the experimental closure of certain selected lock hospitals, and these will show that our protective measures are not powerless, even when enforced with the half-heartedness characterising the efforts made of late years. We shall first note the results obtained in each Presidency separately, and then bring these all together.

In the Bengal Presidency ten lock hospitals which had been in existence many years were closed. The cantonments in which these hospitals were maintained are shown in the following table, and opposite each the admission-ratios for venereal diseases are set forth for 1885 during which they were closed, and for the preceding ten years during which they were open. It will be observed that nearly one-third of the whole army of Bengal, or one-fifth of the army of India was quartered in these stations.

Stations.	Strength.		Admission-ratios.	
	1875–1884.	1885.	1875–1884.	1885.
Chakrata	739	791	164·7	129·0
Murree	362	352	124·8	184·7
Kasauli	514	437	116·1	343·2
Meerut	1,415	1,770	271·5	511·9
Allahabad	988	815	315·7	527·6
Rawal Pindi	1,597	2,217	200·1	482·2
Meean Meer	910	742	230·3	382·7
Peshawar	1,388	1,419	185·8	373·5
Delhi	439	459	206·3	246·2
Cawnpore	852	860	287·8	329·1
Average	9,204	9,862	210·3	351·0

This table shows that with the single exception of the small hill station at Chakrata the admission-ratios of 1885 were greatly in excess of the preceding decennial averages; and the total approximate decennial average of all these stations combined was less than the approximate total average of 1885 by 140·7 per 1,000. The greatest increase in the year's ratio over the ten-year average was exhibited at Rawal Pindi, where it reached 282·1 per 1,000. At Meerut the excess equalled 240·4, and at Allahabad 211·9 per 1,000. These results show very clearly the beneficial influence of the protective measures which had been withdrawn, and are more valuable than the results derived from Madras and Bombay, since the number of men occupying these cantonments almost equalled the total strength of the Madras or Bombay armies.

It has however been objected that such results thus set forth are misleading in that no cognisance is taken of probably equally large increases in protected stations. It is therefore necessary to give the venereal admission-rates in those cantonments also in which lock hospitals continued to be maintained. In framing a table parallel with the foregoing one, and comparable with it in every respect, it is necessary to include only those cantonments in which lock hospitals were uniformly maintained throughout the period of eleven years embraced, and to exclude those which have been intermittently maintained as tending to obscure and vitiate results. In the following table therefore only those cantonments have been included in which the hospitals were uniformly maintained:—

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Stations.	Strength.		Admission-ratios.	
	1875—1884.	1885.	1875—1884.	1885.
Dum-Dum	636	699	253·0	351·9
Barrackpore	309	205	293·9	248·8
Dinapore	901	966	267·8	311·6
Agra	996	926	307·6	434·1
Bareilly	778	777	267·3	471·0
Benares	446	370	466·1	527·0
Roorkee	384	495	205·9	351·5
Muttra	320	383	260·4	188·0
Jhansi	356	361	187·0	243·7
Lucknow	2,238	2,289	317·8	381·8
Fyzabad	794	921	278·3	317·0
Sitapur	423	408	310·2	318·6
Jullunder	659	438	251·2	226·0
Umballa	1,464	1,474	212·9	328·4
Sialkot	907	868	300·2	324·9
Ferozepore	1,018	848	189·2	208·7
Mooltan	851	834	239·0	250·6
Nowshera	621	495	180·2	404·0
Saugor	352	363	272·9	220·4
Jubbulpore	525	615	341·8	473·2
Average	14,978	14,735	270·13	329·06

It is thus evident that in these cantonments also a considerable rise took place; but reasons have been given to account for this as a natural consequence of altered circumstances, and in 1885 especially the indifference displayed by local authorities in carrying out the measures authorised may be expected to have had full force, as the closure of several important lock hospitals would have been regarded as the initial step in the abolition of the whole system. The table shows that in most stations the ratio of 1885 exceeded the approximate previous ten-year average, and that in all stations combined the excess over the previous ten years was 58·93 per 1,000. This excess, however, is considerably less than one-half that shown in stations where the lock hospitals were closed.

In the Madras Presidency in two stations only were lock hospitals closed, and the strength of the garrisons combined bore a small proportion to the total strength of the Madras Army, namely, about one-sixth. The following table shows results similar to those given in the preceding paragraph :—

Stations.	Strength.		Admission-ratios.	
	1875—1884.	1885.	1875—1884.	1885.
Bellary	775	954	405·1	732·7
Cannanore	623	767	182·5	322·0
Average	1,398	1,721	293·8	527·3

In each station the prevalence of 1885 greatly exceeded the ten-year average, the excess at Bellary being as high as 327·6, and at Cannanore 139·5 per 1,000. In both stations combined the excess of 1885 reached 233·5 per 1,000. In the next table similar ratios are contrasted in protected stations.

Stations.	Strength.		Admission-Ratios.	
	1875–84.	1885.	1875–84.	1885.
Bangalore	1,615	1,159	319·6	291·6
Kamptee	879	1,033	230·3	304·0
St. Thomas' Mount	345	288	267·7	215·3
Secunderabad	2,383	2,489	274·3	282·4
Wellington	521	371	210·1	695·4
Average	5,743	5,340	260·4	357·7

Here the total average of 1885 exceeds the total 10-year average by 97·3; also less than one-half the excess exhibited in the former table.

In the Bombay Presidency the following three stations were left unprotected during 1885:—

Stations.	Strength.		Admission-Ratios.	
	1875–84.	1885.	1875–84.	1885.
Ahmedabad - - -	242	250	211·3	420·0
Mhow - - -	1,261	1,267	277·9	410·4
Neemuch - - -	412	343	214·3	478·2
Average - -	1,915	1,860	234·5	436·2

The combined strength of the garrisons was, as in the case of Madras, about one-sixth of the total strength of the Army. In each station the ratio of 1885 greatly exceeded the average of the previous 10 years, ranging from an excess of 132·5 at Mhow to 263·9 in Neemuch. The combined ratio of 1885 exceeded the combined average ratio by 201·7 per 1,000. In the seven protected stations enumerated in the next table the combined excess of 1885 was only 27·5 per 1,000.

Stations.	Strength.		Admission-Ratios.	
	1875–84.	1885.	1875–84.	1885.
Aden - - - -	752	766	115·9	99·2
Ahmednagar - - -	428	503	260·3	312·1
Belgaum - - -	859	888	292·5	288·3
Deesa - - -	475	418	159·4	186·6
Kurrachee and Ghizree - -	792	819	134·7	171·9
Nusseerabad - - -	612	648	222·0	307·1
Poona and Kirkee - -	1,806	1,717	241·7	255·1
Average - -	5,724	5,759	203·8	231·3

This excess is equal to about one-seventh the increase in the three stations named in the preceding table.

Bringing all these data together in one table, we get the following net results:—

Presidency.	Strength.		Admission-Ratios.		Difference.
	1875–84.	1885.	1875–84.	1885.	
Bengal - - -	9,204	9,862	210·3	351·0	+140·7
Madras - - -	1,398	1,721	293·8	527·3	+233·5
Bombay - - -	1,915	1,860	234·5	436·2	+201·7
Average - -	12,517	13,443	246·2	438·2	+192·0

It, therefore, appears that during 1885, 13,443 men, or nearly one-fourth of the Army of India which was formerly protected, was left without protection, and in consequence in every thousand of these men 192 more admissions were made for venereal disease than the average of the 10 preceding years, when they were protected. But in order to obtain a more exact estimate of the increase of disease due to the experimental closure of these hospitals, we must eliminate the excess which would probably have occurred even if they had remained open, and this excess will be equal to that which occurred in the cantonments which still continued to be protected. The combined results in these latter cantonments are set forth in the following table:—

Presidency.	Strength.		Admission-Ratios.		Difference.
	1875–84.	1885.	1875–84.	1885.	
Bengal - - -	14,978	14,735	270·1	329·0	+58·9
Madras - - -	5,743	5,340	260·4	357·7	+97·3
Bombay - - -	5,724	5,759	203·8	231·3	+27·5
Average - -	26,445	25,834	244·8	306·0	+61·2

It thus appears that whilst the excess in those cantonments in which lock hospitals were temporarily closed was 192·0 per 1,000, it was only 61·2 in the cantonments in which these hospitals were still maintained. In other words, the result of the experiment means that 130·8 per 1,000 of those men who garrisoned the cantonments where lock hospitals were closed contracted venereal disease, who would not have suffered had the hospitals remained opened. As the strength of the Army of India was 56,967 this again means that the experiment caused 7,451 more admissions than would otherwise have taken place, and assuming, as before, that each case remained on an average 20 days in hospital, this would represent 149,020 days of inefficiency.

In estimating the effect of protective measures against venereal disease, it has been argued that attention should be confined to the statistics of primary syphilis as the only form of the disease indicating a true rate of infection. The ratios for primary syphilis given in the following table show that they rise and fall in close correspondence with those for all forms of venereal disease combined.

Year.	Army of India.	Army of Bengal.	Army of Madras.	Army of Bombay.
1871 - -	67·7	73·3	55·9	60·9
1872 - - -	61·5	61·9	65·4	54·4
1873 - -	53·4	49·1	62·6	58·5
1874 - - -	67·5	66·3	79·3	63·0
1875 - -	67·1	71·3	69·8	48·7
1876 - - -	59·8	59·8	60·5	59·2
1877 - -	65·2	55·7	96·8	64·8
1878 - - -	95·3	96·2	106·1	79·9
1879 - -	79·2	62·0	114·5	109·3
1880 - - -	87·9	83·4	107·3	85·6
1881 - -	92·0	96·0	89·0	81·4
1882 - - -	87·6	87·9	109·6	67·8
1883 - -	87·2	87·7	111·1	62·8
1884 - - -	90·2	86·7	101·7	89·7
1885 - -	122·1	129·3	123·7	98·7

Information regarding the number of days spent in hospital by each man admitted for venereal disease in the Army of India cannot be furnished.

Thus the primary syphilis ratios for the whole Army of India are seen to present the same marked accentuations in 1878, and especially in 1885, which were shown to exist for all forms of venereal diseases combined, and the minor fluctuations also correspond closely. The same close parallelism will also be observed to exist when we compare the statistics of the several Presidencies separately. In the Armies of the Bengal and Bombay Presidencies the rises and falls correspond very closely, although in the Madras Army some anomalous divergencies occur. For example, in the latter Presidency the rise in the primary syphilis admission-ratios during 1877–79 was disproportionately greater than the rise which took place in the ratios for all forms of the disease together; but in subsequent years the rises and falls in the ratios for venereal diseases combined were closely followed by the ratios for primary syphilis alone.

If we now turn our attention to the indications of the returns for primary syphilis alone afforded by the experimental closure of lock hospitals during 1885, we shall find the same undoubted increase of this special form of the disease in those stations which were left temporarily unprotected, as we found to be the case in a preceding paragraph for all forms of venereal disease taken together. In the following table the admission-ratios

for primary syphilis alone are given during 1884 and 1885 in protected stations, unprotected stations, and stations in which lock hospitals were temporarily closed:—

—	1884.	1885.	Difference.
Protected stations - -	65·1	109·9	+44·8
Unprotected stations - -	132·2	168·4	+36·2
Stations in which lock hospitals were suspended during 1885.	76·9	141·6	+64·7

It now only remains to adduce further evidence to show that the rules framed in 1864 for the prevention of venereal disease are capable of accomplishing much good. The records of almost every single station in which a lock hospital has been maintained show that the disease among the troops declined soon after the introduction of the Act, and it is evident that if the admission-ratios can once be reduced, they can be kept near those reduced rates were sufficient care taken to do so. Thus in looking over the records of the cantonments of the Bengal Presidency for many years, it appears that of 36 of the principal of these in which lock hospitals were maintained, 29 recorded the lowest admission-rates after the introduction of lock hospitals, whilst in 7 only were the lowest ratios recorded before their introduction. Sufficient reasons no doubt existed for these latter exceptional cases; but in order to discover them a detailed knowledge of the history of these cantonments would be necessary, a knowledge which it has been impossible for me to acquire. The history of the introduction of the Act, however, shows much more forcibly what may be accomplished when its rules are enforced with the enthusiasm usually bestowed upon novel and well-supported measures. In the first annual report of the Sanitary Commission for Bengal (1864–65) under the presidentship of Mr. John Strachey, it is noted that at least one-third of the whole Army ordinarily passes through hospital in one year on account of venereal disease. In some stations as many as 50 to 70 per cent. thus pass through hospital. The opinion of Dr. Duncan Macpherson, Inspector-General of Hospitals, is also quoted to the effect that "fully two-thirds of those who imbibe the "disease are invalided within five years." It was stated also that experience both in Europe and in India made it probable that preventive measures would have the effect of diminishing, to a very great extent, these frightful evils. The necessity for adopting preventive measures being fully acknowledged, a commission under Major Malleson was appointed in 1865 to prepare rules for the purpose. Their aim in framing those rules was "not that the Government should do everything which may "possibly be useful, but that it should do nothing which will have to be undone "again afterwards." The rules were approved, and under orders dated 22nd March 1866 were introduced within the North-Western Provinces to the cantonments of Jubbulpore and Saugor in the Central Provinces, and into all military stations in Oudh. The first reports on the results of these preventive measures all went to show with what success they had been attended. "Remarkable success" was claimed for them in Lucknow, where the admission-rate fell from 252 per 1,000 in the preceding year to 180 per 1,000 in 1867, or to 62 per 1,000 during the latter half of the year. At Meerut also the results were said to have been "extremely favourable"; at Roorkee a "decided success." The favourable results in Oudh were said to "illustrate what may be effected when the authorities, civil and military, heartily "co-operate." In Sitapur the total admissions in 1866 equalled 481 per 1,000, whilst for the last six months of 1867 the rate fell to 54 per 1,000. Finally it was recorded: "The results of 1867 compare very favourably with those of any of the previous "eight years. * * * * * a diminution of from 359 admissions to 166 per "1,000, or less than one-half, is very decided, and speaks well for the preventive "measures adopted." A little later, when enthusiasm began to flag and admission-rates commenced to go up again, it was still maintained that the system was not so much at fault as the spirit in which it was worked. In the annual report of 1871 it is stated:—"Although the results of the working of the rules for the prevention of "venereal disease have by no means been so satisfactory as are desired, the expe-"rience of certain stations where they have been carefully administered during a "series of years, such as Roorkee, Meerut, and Mooltan, show beyond all question that

" with proper management a very decided impression may be made on the prevalence " of venereal disease among the European troops." In 1873 again the total admission-rate, namely, 166·7 per 1,000, was noted as the most favourable on record; and it was shown that admissions for primary syphilis fell from 61 to 49 per 1,000, whilst the same ratio in the United Kingdom in stations under the Act was 52 in 1871. But now the influences noted above began to appear, and together with increasing want of interest on the part of local authorities in working a system which to many was from a false moral sentiment extremely distasteful, tended to raise the admission-rates gradually to the high maximum attained in 1885. This short history of the progress of the Act shows that the system, with all the imperfections it may have, if vigorously pursued, can result in much suppression of these preventible and much disabling diseases.

ABSTRACT OF REPORT OF THE ACTING SANITARY COMMISSIONER FOR MADRAS FOR 1885.

(*Deputy Surgeon-General W. Farquhar, M.D.*)

European Troops.

Sickness and mortality among European troops.

The strength of Her Majesty's European troops belonging to the Madras Command in 1885 was 14,493. The health of the force was good, although in some respects not so satisfactory as in the previous year, there having been an increase in the daily sick, admission and death rates. The admission-rate for the year was 1,165·3, and the daily sick-rate 66·1, per 1,000 men, against 1,106·1 and 59·1 respectively, the results in 1884. The mortality was in the ratio of 9·2 per 1,000, and, although higher than in the preceding year, still very low, more especially considering the extent to which epidemic disease prevailed in towns and villages.

The subjoined statement gives for a series of years the chief facts connected with the health of European troops serving in Madras:—

Years.	Ratio per 1,000 of Strength.			Invalided per 1,000 of Strength.	
	Admitted.	Daily Sick.	Died in and out of Hospital.	Change of Climate.	For Discharge.
1870	1,481·5	63·9	19·7	70·4	6·6
1871	1,211·5	56·2	19·1	29·7	12·5
1872	1,352·3	59·7	19·2	26·8	11·2
1873	1,270·8	59·3	18·5	50·6	12·7
1874	1,141·2	57·6	13·4	29·5	8·3
1875	1,096·3	56·9	14·8	60·8	15·5
1876	1,132·9	55·2	16·1	31·9	10·9
1877	1,172·2	58·7	17·2	36·0	10·2
1878	1,379·7	65·8	22·1	36·6	9·1
1879	1,438·7	68·4	16·8	34·3	10·2
1880	1,385·4	68·4	9·9	15·0	8·0
1881	1,164·8	68·2	11·1	18·6	8·8
1882	1,069·4	59·3	10·4	17·6	12·0
1883	991·0	59·7	10·0	20·1	13·6
1884	1,106·1	59·1	8·5	20·9	11·4
1885	1,165·3	66·1	9·2	—*	—*

* Information not available.

These figures show that, while there has been a reduction in the admission and death rates, the daily sick-rate still stands high. The synchronous decline in the death and invaliding rates in recent years is satisfactory, as it shows an unquestionable improvement in the health state of the troops, inasmuch as the sick have not been sent out of the country to recover or die. The change may, however, be due partly to the fact that we have had to deal mostly with younger, and therefore more vigorous, men.

Omitting small stations and convalescent depôts, the average daily sick-rate per 1,000 strength ranged from 83·5 in Bellary to 47·5 in Rangoon. The other cantonments showing high ratios are Madras, 80·5; St. Thomas' Mount, 79·2; Toungoo, 68·5; Secunderabad, 68·8; and Cannanore, 67·2. Again, excluding the lesser stations and depôts, the ratio of deaths in hospital per 1,000 men ranged from 14·1 at St. Thomas' Mount to 1·0 in Kamptee, but at the latter there also occurred 1 death out of hospital.

The chief causes of inefficiency amongst the troops were venereal complaints, fevers, and skin diseases.

There were 6 admissions from cholera with 2 deaths, against 12 with 10 deaths in 1884. The cases occurred 1 each at the stations of Kamptee and Toungoo, and 4 at Secunderabad.

There were in all 6 admissions from small-pox, with no deaths against 19 with 1 death in 1884.

There was a marked decrease in the prevalence of typhoid fever, but a notable increase in the mortality. Thus, in 1884, there were 129 cases, with 18 deaths, giving a mortality of under 14 per cent., whereas last year there were 73 cases, of which 23 were fatal, giving the very large death ratio of 31·5 per cent. The largest number of cases in any one station, viz., 29, occurred in Secunderabad, and out of these 10 were fatal. In Bangalore there were only 18 admissions, against 60 in 1884. In Bellary there were 8 cases, and at Port Blair 4.

Paroxysmal fevers were also less prevalent, there having been 713 cases of ague and 50 of remittent fever, against 762 and 104 respectively in 1884. These results are satisfactory, considering the extent to which fevers prevailed amongst the civil population.

The admissions for diarrhœa were at the rate of 41·3 per 1,000 strength, and numbered 429 against 452 in the previous year. The admissions for dysentery were 562 against 602, and in the ratio of 54·1 per 1,000. It is satisfactory to note that there were but 4 deaths from dysentery, giving a rate of 0·4 per 1,000, and none from diarrhœa.

The admissions from hepatic diseases were 354, and the deaths 14, against 310 and 23 in the previous year. The results for 1885, therefore, give an admission-rate of 34·1 and a death-rate of 1·3 per 1,000 men.

Sunstroke and heat apoplexy caused 15 admissions and 4 deaths, against 12 and 5 respectively in 1884.

Venereal diseases again gave rise to an enormous amount of inefficiency, and the admissions show an increase on the results of 1884, the admission-rate having been 308·3 per 1,000 in the former, against 256·1 in the latter year. The admissions were most numerous in Secunderabad, Bellary, Madras, Bangalore, Rangoon, and Wellington.

Native Troops.

Sickness and mortality among Native troops.

The strength of the native force belonging to the Madras Army in 1885 was 30,893. This includes the whole of the men wherever serving, but the present review only deals with troops located within the Madras Command, whose average strength, according to the weekly returns, aggregated 25,190.

This portion of the native army was decidedly healthier than in the previous year. There was less sickness, as the admission-rate per 1,000 men fell from 749·3 in 1884 to 666·0; and the ailments must have been of a less severe type, as the daily sick-rate declined from 32·8 to 28·9, and the death-rate of patients in hospital from 9·0 to 7·8. The admission-rate in 1885 was, with one exception, the lowest since 1868, and so was the death-rate.

The principal causes of sickness amongst native troops were fevers of the paroxysmal type, which caused 34 deaths, giving a ratio of 1·3 per 1,000 of strength. Next to fevers the most fatal complaints were respiratory diseases, chiefly pneumonia, the death-rate from these having been 1·0 per 1,000 men. Of the 48 cases of cholera, 25 died, giving a death-rate of 0·9 per 1,000. The other diseases which mainly contributed to the mortality were dysentery 0·4, diarrhœa 0·3, phthisis pulmonalis 0·5, heart-diseases 0·3, and continued fevers 0·2. One man died of hydrophobia. There were 24 cases of small-pox with 1 death, against 66 with 5 deaths in 1884.

The admissions for venereal complaints were in the ratio of 17·2 per 1,000 strength, against 22·7 in 1884.

Jails.

Sickness and mortality in jails.

The number of prisoners in jail on the 31st December 1884 was 6,956, while the additions in 1885 amounted to 16,457, making a total of 23,413, or 1,068 more than in the previous year. The year closed with a jail population of 7,307. The most notable points in these figures are the reduction, as compared with the results in 1884, in the numbers of deaths and executions, the former showing a decline of 20 and the latter of 19.

It will be noted that, after excluding Her Majesty's Jail, Madras, and the European Prison, Ootacamund, the average population in 9 jails was about or under 100, and, although not exactly within the province of the Sanitary Department, it may be allowable for me, as an official visitor, to suggest that it would probably be economical

to close the smaller prisons and concentrate the inmates in larger institutions. Another point deserving of consideration is whether at any rate the smaller jails might not be constructed on a somewhat less expensive scale, without sacrificing anything likely to keep the prisoners in health and in security. Some of the simple older jail buildings were probably unhealthy, not on account of their inexpensive mode of construction, but because of insufficient space and other faulty arrangements.

The prisoners enjoyed exceptionally good health in 1885, as both the admission and death rates—701·9 and 17·4 per 1,000 respectively—were lower than in any other year on record.

Some of the most common forms of jail sickness, such as diarrhœa, paroxysmal fevers, and respiratory diseases, were less prevalent than in 1884, but dysentery, rheumatism, heart-diseases, continued fever, and skin diseases were more frequent. It is satisfactory to note that dropsy and scurvy were less common than in 1884, and that there were but 6 cases of cholera against 24, and 13 of small-pox against 14, although both diseases were so prevalent amongst the free population. Such immunity is highly creditable to the sanitary state of our prisons.

The chief causes of sickness were in the order of their frequency—intermittent fevers (163·1 admissions per 1,000 of population), skin diseases (86·5), diarrhœa (58·6), dysentery (43·7), continued fever (26·2), respiratory complaints (25·4), rheumatism (19·4), guinea worm (19·3), heart-diseases (4·9), phthisis (4·5), dropsy (4·1), chicken-pox (3·4), small-pox (1·8), cholera (0·8). With two exceptions, there were some cases of paroxysmal fevers in every jail in the Presidency, but the largest numbers occurred in the Central Jail, Rajahmundry, and in the Chittoor Jail. Of the 13 cases of small-pox, 6 occurred at Calicut, 2 at Palamcottah, and 2 in the Penitentiary, Madras. The jails invaded by cholera were Trichinopoly Central 3 cases, Cuddalore 2, and Kurnool 1. Taking into account the excellent sanitary condition of jails, the occurrence of malarial fevers amongst the prisoners year after year to such an extent would seem to indicate that the causes, if local, must be sought for outside the jail premises.

Taking the average daily sick-rate per 1,000 of strength as a test of the health state of the several prisons, the most unhealthy were Rajahmundry District Jail, 125·7 per 1,000, Her Majesty's Jail, Madras, 78·4, Chingleput 62·2, Kurnool 57·3, Ootacamund—Native—53·5, Cannanore Central 49·8, Mangalore 44·7, and Guntur 40·3. The healthiest, judging by the same standard, were Tellicherry (since abolished) 1·1 per 1,000, Berhampore 8·3, Vizagapatam 12·9, Palamcottah 13·7, and Trichinopoly District and Bellary Jails 15·6 each. The chief causes of sickness in the Rajahmundry District Jail were paroxysmal fevers; in Her Majesty's Jail, Madras, respiratory diseases and dysentery; in Chingleput continued fevers and skin diseases; in Kurnool malarial fevers, diarrhœa, dysentery, and 1 case of cholera; in Ootacamund—Native—diarrhœa, dysentery, and chicken-pox; in Cannanore Central diarrhœa, dysentery, malarial fevers, rheumatism, respiratory complaints, and skin diseases; in Mangalore intermittent fevers, dysentery, diarrhœa, and skin diseases; and in Guntur continued and malarial fevers, dysentery, and respiratory complaints.

For some years, with the exception of 1882, there has been a satisfactory decrease in the death-rate of our jails, the decline having been from 55·8 in 1879 to 17·4 in 1885. The rates in the latter year ranged from 48·1 per 1,000 strength in Nellore District to 2·5 in Salem Central Jail. The mortality in the Central Jails was as per margin. In Cannanore, amongst others, there were 2 deaths from dysentery, 2 from Bright's disease, 1 from phthisis, and 1 from general debility; in this jail a great many of the prisoners are aged. In the Coimbatore Prison the chief causes of mortality were general debility 6, diarrhœa 3, and pneumonia 2. In Trichinopoly Jail there were 1 death from cholera, 2 from diarrhœa, 2 from phthisis, and 1 each from tetanus, tuberculosis, diabetes, epilepsy, and apoplexy.

	Ratio of Deaths per 1,000 of Strength.
Cannanore, Central	28·6
Coimbatore do.	21·3
Trichinopoly do.	20·0
Rajahmundry do.	18·9
Vellore do.	5·5
Salem do.	2·5

The district jails have had throughout less sickness than the central. In the five-year period (1880–1884) they also show a lower death-rate, but in 1885 the reverse was the case. On the whole, however, the district jails have been the healthier, which was to be expected, as their inmates have shorter terms of incarceration, and live under less rigorous conditions as to labour, &c., than those in central jails.

In jails generally, of all causes of death general debility was the most common, but it is desirable that efforts should be made in such cases to secure a more exact

diagnosis. The other more notable causes of death were diarrhœa (11 deaths), dysentery (11), phthisis pulmonalis (9), pneumonia (8), general dropsy (7) and valve disease of heart (6). The diseases requiring the special attention of the jail authorities are general debility, diarrhœa, dysentery, and dropsy. The year passed away with but 3 deaths from cholera, viz., 1 in Cuddalore, 1 in Kurnool, and 1 in Trichinopoly Central. In the previous year also Cuddalore and Trichinopoly Jails were visited by cholera. One case of death from guinea worm occurred at Bellary.

General Population.

Vital Statistics.

The District Municipalities Act, No. IV. of 1884, makes provision for the important duty of registering births and deaths, and the better educated members of the community are beginning to recognise the importance of such records for legal as well as other purposes. In the towns, therefore, we may anticipate steady although slow improvement in registration, but in the villages, where there are no special agents for the duty, the prospect is not so hopeful. Some good will no doubt result from the systematic inspection of the registers by the superior revenue officials and district medical officers when on tour, as suggested last year. District medical and sanitary officers might also exercise a more rigorous check over the district returns as they pass through their hands on their way to the Sanitary Commissioner, and at once bring obviously defective registration to the notice of the Collector. Such supervision would not only conduce to greater accuracy, which is of the very highest importance, but also often enable the medical officer to give timely warning to the district authorities of the unusual prevalence of sickness.

The births in 1885 (824,042) were, as in the previous year, in the proportion of 29·3 per 1,000 of population, and the rates varied in the several districts from 16·1 on the Nilgiris to 43·5 in Kurnool. In every district, except Godaveri and Nilgiris, the births were more numerous than the deaths, the excess per 1,000 of population ranging from 20·7 in Kurnool to 2·0 in South Arcot. The difference is so great in the case of the former as to lead to the inference that the deaths are understated. Last year also the deaths were in excess of the births in the Godaveri district, and the causes which chiefly led to this result in 1885 were, putting aside defective registration, cholera, small-pox, and fever. On the Nilgiris registration is very unsatisfactory, but the death-rate there in 1885 was undoubtedly increased by the large fever mortality.

The births of boys were in the ratio of 104·6 to every 100 girls born, and, therefore, in exactly the same proportion as in 1884. In European countries the ratio varies from 103·9 in England and Wales to 107·1 in Italy.

With a birth-rate of 29·3 there was a mean death-rate of 21·8, so that the natural increase of the population was 7·5 against 6·2 in 1884. The rise is obviously due to the lower death-rate in 1885.

The deaths in 1885 numbered 615,449, giving a rate per 1,000 of population, of 21·8 against 23·1 in the previous year. This decrease was largely due to the decline of cholera and small-pox in 1885. The subjoined table shows the registered mortality during each of the past 17 years :—

Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000	Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000.
1869	24,633,127	451,981	18·3	1878	29,127,205	810,921	27·8
1870	24,125,526	451,020	18·6	1879	28,991,267	549,390	18·9
1871	24,555,046	444,371	18·0	1880	28,778,097	454,101	15·7
1872	30,147,779	501,482	16·6	1881	28,676,375	465,682	16·2
1873	30,287,842	506,894	16·4	1882	28,887,111	470,700	16·2
1874	30,360,221	516,848	17·0	1883	28,503,100	541,930	19·0
1875	30,278,903	641,260	21·1	1884	28,151,952	650,335	23·1
1876	29,157,056	680,384	23·3	1885	28,118,178	615,449	21·8
1877	29,209,542	1,556,312	53·2				

These figures show that we have had a gradually increasing death-rate since 1880 the maximum having been reached in 1884. The chief causes of this progressive

mortality were epidemics, but there is now the prospect of our having entered on a healthier cycle.

The number of males who died was in the proportion of 106·3 to every 100 deaths of females. Reckoned according to population, the male deaths were in the proportion of 22·7, and the female in that of 21·0 per 1,000.

The ratio of mortality in the districts, excluding Madras, ranged from 16·2 per 1,000 in Nellore to 26·3 in the Godaveri. In six district the rates were less, and in 14 more, than 20 per 1,000. Some of the districts show such a persistent uniformity in low death-rates, notwithstanding the presence of epidemic disease, as to be clearly indicative of very defective registration. In the town of Madras the death-rate in 1885 was 36·4 per 1,000 against 49·4 in 1884 and an average of 39·5 in the previous five years. Two of the chief causes of this heavy mortality were fevers and bowel-complaints, diseases largely due to insanitary conditions.

Taking the mean of the births in 1884 and 1885 as approximately representing the infant population in the latter year, the death-rate amongst this section of the community was in the ratio of 158·4 per 1,000. Calculated on the births during the year, the deaths amongst infants were in the ratio of 158·7 per 1,000 against 171·4 in 1884. The decline in the former year was no doubt largely due to the decreased prevalence of cholera and small-pox. Putting aside epidemic disease, infant mortality, as a general rule, depends largely on feeding, children which are breast-fed having by far the better chance of surviving. Next to feeding, sanitary surroundings have the greatest influence on infant vitality. In England during the decennium, 1871–80, the infant mortality per 1,000 births was 148, and in London during the same period 156. The deaths in Madras during 1885 of children over one and under five years of age, numbered 93,841, being in the ratio of 32·5 per 1,000, a rate which does not compare unfavourably with the results in some European countries. The proportions of deaths at ages under five to the deaths at all ages was 36·5 per cent,

The following table shows the deaths in town and country from the chief causes of sickness :—

	Ratio of Deaths per 1,000 of Population.					
	Cholera.	Small-pox.	Fevers.	Bowel-complaints.	Injuries.	All other Causes.
In districts - -	1·9	1·2	7·9	1·0	0·4	9·0
In towns - -	3·3	1·2	5·2	2·6	0·3	12·8

It will thus be seen that cholera and bowel-complaints were much more fatal amongst the town than the rural population, while as regards fevers and injuries the reverse was the case. Small-pox shows the same death-rate in town and country. Judging from the death-rates amongst the rural population, the most unhealthy districts were apparently Godaveri (26·1), South Canara (25·8), Chingleput (25·2), Tinnevelly (24·8), and Kistna (23·1); and the healthiest Nellore, Coimbatore, Nilgiris, and Vizagapatam. One town, Tenkasi, had the enormous death-rate of 50·7 per 1,000, this high ratio being mainly due to cholera, small-pox, and fever. This place evidently needs the anxious attention of the local authorities. The other towns showing exceptionally high death-rates are Tuticorin (41·7), Nachiarcoil (38·5), Palghat (37·7), Ongole (36·3), Berhampore (36·1), Cochin (35·9), and Ellore (35). It thus appears that the three towns showing the highest death-rates were all in the Tinnevelly district. If local authorities could be induced to watch more closely the vital statistics of their districts they would discover where improvements are most needed, and a greater impetus would certainly be given to the only safeguards of public health and life, viz., sanitary improvements.

The following abstract shows the chief causes of death amongst the civil population of the Presidency for a series of years, and it is satisfactory to note that there was a marked reduction as compared with the previous year in the deaths from cholera and small-pox. On the other hand the mortality from fevers and bowel-complaints shows an increase.

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866 - - -	600,106	200,961	23,106	110,102	—	9,047	256,890
1867 - - -	372,026	33,205	27,907	112,511	—	8,613	189,790
1868 - - -	390,959	8,036	34,330	105,692	—	9,242	233,659
1869 - - -	451,981	21,034	17,448	132,346	—	9,310	271,843
1870 - - -	451,020	55,867	11,252	151,027	—	12,325	220,549
1871 - - -	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872 - - -	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873 - - -	506,894	840	51,784	222,843	36,392	14,251	180,784
1874 - - -	516,848	313	48,343	226,220	37,993	13,065	190,914
1875 - - -	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876 - - -	680,384	148,193	23,469	230,092	38,176	11,175	229,279
1877 - - -	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878 - - -	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879 - - -	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880 - - -	454,101	613	14,529	209,940	19,622	10,845	198,552
1881 - - -	465,682	9,446	15,776	203,542	18,961	11,527	206,430
1882 - - -	470,700	23,604	20,159	188,561	19,958	11,611	206,807
1883 - - -	541,930	36,284	37,975	203,786	22,098	11,509	230,278
1884 - - -	650,335	75,476	61,247	215,977	28,775	11,502	257,358
1885 - - -	615,449	58,109	34,726	218,786	31,209	11,659	260,960

Cholera.

The history of the great cholera epidemics in Southern India shows in the case of each a stage of growing intensity, extending over two or three years, and a stage of decline of somewhat shorter existence. Then comes a period of repose of one or two years duration to be followed by another outbreak. Usually the maximum mortality is attained in the second or third year of an epidemic. In the case of the outbreak now on the decline, it appears to have been deferred till the third year of its existence.

Looking at the seasonal mortality from cholera in this Presidency during the last five or six years, it seems obvious that the present outbreak began in the last quarter of 1881. In that year the deaths from the disease amounted to 9,446 and they rose to 23,604, 36,284, and 75,476 in 1882, 1883, and 1884 respectively. During each of the latter three years, there has been a decline in intensity about the change of the monsoons, due probably to the meteorological conditions then prevailing, but no break in continuity sufficient to indicate the close of one and the beginning of a new outbreak. In the year just closed, the cholera deaths numbered 58,109, still a very large mortality, but less by 17,367 than in 1884; and as the epidemic has now lasted over four years, we may fairly expect a rapid decrease in 1886.

In 1884 the districts which suffered most from cholera were those in the south and centre of the peninsula, and the mortality in these ranged from 11·1 per 1,000 of population in Tanjore to 1·4 in Salem. In 1885 there was a marked decrease of deaths in the south, the mortality in the districts which chiefly suffered there having been as per margin. In the north, on the contrary, the disease gained fresh vitality, so that Ganjam had a death-rate per 1,000 population of 3·4 against 0·1 in 1884; Godaveri of 3·3 against 0·4; Kistna of 3·1 against 1·0; and Vizagapatam of 1·2 against 0·009.

—	Ratio of Deaths per 1,000 of Population.
South Arcot - - -	4·4
Tinnevelly - - - -	3·4
Trichinopoly - -	3·2
Madura - - -	2·9
Tanjore - - -	2·3
Coimbatore - - -	2·2
Salem - - -	1·9
North Arcot - - -	1·6

By far the largest numbers of deaths from cholera in 1885 were recorded in the first quarter of the year, and of these the greatest proportion (22,885) occurred in January. In February the mortality declined to 8,366, and thereafter there was a rapid decrease till July, in which month the disease manifested an increasing tendency, mainly in the north, but also in South Arcot and some others of the southern districts. From July onwards the monthly decrease was marked and satisfactory, and in December there were only 664 deaths against 19,313 in the corresponding month of 1884. The great reduction in mortality during the last month of the year is a very satisfactory feature in the course of the epidemic, inasmuch as it leads me to hope that the outbreak is drawing to a close.

Throughout the protracted invasion of cholera now on the wane, the districts of Cuddapah, Kurnool, Bellary, Anantapur, and to some extent Nellore, as also those on the west coast, have enjoyed a comparative freedom from the disease, although

every year there have been cases in some of them indicating the presence of the epidemic influence. In the present state of our knowledge of cholera it is useless to speculate as to the cause of this partial immunity, and the most that can be said, in the face of the fact that the insanitary condition of all our rural circles is very much alike, is that some other essential condition was wanting in the districts in which the disease failed to gain a footing and make any great advance.

The marginal figures show the death-rates from cholera, district by district, during the past 20 years, and bring out very clearly how much more severely some suffer than others. At the same time they must not be taken as an accurate measure of liability to outbreaks, or of the extent to which the several districts may respectively suffer when an invasion takes place, as in numerous instances the ordinary death-rate from the disease was disturbed to an enormous extent by the fatality during the famine years. Thus in the case of the Bellary district out of a total of 81,686 cholera deaths, no less than 53,324, or 65·2 per cent., happened in 1875–78. The districts for which special allowance should be made with regard to this disturbing factor are Bellary, Cuddapah, Salem, North Arcot, Coimbatore, Nellore, and South Arcot.

Districts.	Ratio of Deaths per 1,000 of Population.
Tanjore	62·8
Cuddapah	59·6
Salem	58·6
Bellary	57·8
Trichinopoly	54·8
South Arcot	54·7
North Arcot	51·6
Coimbatore	50·2
Ganjam	48·9
Tinnevelly	47·5
Kurnool	45·4
Godaveri	44·4
Madura	41·5
Madras Town	40·8
Kistna	33·4
Nellore	31·3
Chingleput	25·1
Vizagapatam	23·4
Malabar	17·1
Nilgiris	10·4
South Canara	9·01

In the town of Madras there were 123 cholera deaths in 1881, 426 in 1882, 166 in 1883, 1,142 in 1884, and 181 in 1885, so that the sanitary improvements which have been carried out have not yet been sufficient to entirely protect it from cholera invasions. This is hardly to be wondered at considering the density of the population, as much in one part as 128,400 per square mile, and the want of drainage, the older drains being simply channels of rotten porous brick and worse than useless. It is with regret too that I observe that Guntur town, which for some years has been deemed cholera-proof, has a record of 107 deaths from the disease in 1885.

It will be noted that, although cholera was much less malignant in 1885, it was more widely dispersed than in the previous year, as not a single district escaped it entirely. Out of the 51,977 villages in the 21 districts, excluding Madras, 7,384, or 14·1 per cent. were invaded by the disease.

The mean ratio of the total cholera mortality throughout the Presidency was 2·0 per 1,000 of population against 2·7 in 1884 and 1·0, the mean ratio of mortality during the previous 5 years. The death-rate was by far greatest in towns, the mortality there having been in the ratio of 3·3 per 1,000 against 1·9 in rural districts.

Small-pox.

The mortality from small-pox in 1885, although still high, was much less than in the preceding year. The deaths numbered 34,726 against 61,247 in 1884, and therefore show a reduction of nearly one-half. The death-rate in 1885 was 1·2 against 2·1 in 1884 and 1·0, the mean annual ratio per 1,000 during the previous 5 years. The disease prevailed more or less in every district of the Presidency.

According to age, 12,711, or over 36 per cent. of the total deaths, were in young people under 12 years and over 1 year of age. Amongst children under 1 year the deaths amounted to 5,774. They, therefore, contributed 16·6 per cent. of the total small-pox mortality of the year, and were in the ratio of 6·4 per 1,000 of the probable infant population and that of 44 per 1,000 of deaths from all causes amongst infants. The relatively small number of deaths of infants is remarkable, but I am not prepared to say that it was entirely due to vaccination.

The present epidemic of small-pox began in January 1883 and the total deaths during that year numbered 37,975. In 1884 the outbreak was at its maximum, the total mortality for the year having been 61,247. The only district in which the disease was very severe was the Godaveri, the death-rate there per 1,000 living having been 4·9. The next highest death-rates were 1·8 in Malabar, 1·6 in Kistna, 1·5 in South Arcot, 1·4 in Kurnool and Vizagapatam, respectively, and 1·3 in Nellore. Undoubtedly where small-pox is strongest vaccination is weakest, and it is to be hoped that the local authorities in such districts will push on vaccine operations, more especially amongst the young, so as to prevent another outbreak, or at any rate mitigate it when it does come. Madras town suffered very severely during the present epidemic. Of the total of 5,959 deaths, 2,304 occurred in infants and 3,477 in children under 12 years of age, leaving a balance of 178 for deaths of individuals

above 12. Nothing could more plainly show than these results how very inefficient the municipal vaccination must have been for years past. Of the total deaths, 97 per cent. were in infants and children, the legitimate inference from this being that a large proportion of the young is either unprotected or imperfectly vaccinated. The small number of deaths of individuals above 12 is also significant, as taken in connexion with the evident neglect of vaccination in the young it would seem to indicate that a large proportion of the growing and adult population who escaped small-pox owed their immunity to a previous attack. Supposing that in the course of the late outbreak there were three attacks for every death, then no less than 17,877 must have suffered from the disease, and of these there will now remain alive 11,918 individuals who have been effectually protected, but at the peril of their lives. It is to be hoped that in course of time more general and satisfactory protection will be secured, now that vaccination has been made compulsory within the bounds of the municipality. If, however, the work is bad or the numbers said to be vaccinated unreliable, those responsible may rest assured that their negligence will be found out on the next occasion that an epidemic wave of small-pox visits Southern India.

Fevers. The deaths from this cause in 1885 amounted to 218,786, and were therefore in the ratio of 7·7 per 1,000 of population. On an average fever destroys about three times as many as the two other great scourges of the population. Although every ailment accompanied with a rise of temperature is spoken of by natives as fever, probably the errors thus introduced into our statistics are counterbalanced by the failure to register a number of deaths that are undoubtedly due to fever. The fatal fevers from which the people suffer are almost, without exception, of a paroxysmal type, and therefore to a great extent an index of the sanitary state of the country. At the same time it must be stated that in certain localities and over large tracts of country there are abiding malarial influences of a fluctuating character due to conditions which are hardly under human control.

The districts which showed the largest mortality in 1885 were Kurnool (16·2 per 1,000), Vizagapatam (13·7), Nilgiris (13·3), Cuddapah (13·0), Ganjam (10·7), Malabar (9·6), and South Canara (9·4). In Tanjore the death-rate was lowest, having been only 1·5 per 1,000 living, but the rates in the remaining 13 districts ranged from 9·2 to 3·4. In 13 districts the ratios of deaths were in excess of the mean rate for the previous 5 years and in 8 less.

Bowel-complaints. The deaths from bowel complaints amounted to 31,209, or over 5 per cent. of the total mortality from all causes. With reference to population, the deaths were in the ratio of 1·1 per 1,000, while the rates from fever, cholera, and small-pox mortality were, respectively, 7·7, 2·0, and 1·2 per 1,000. The death-rates during the past 5 years from bowel-complaints showed the well-known tendency to increase in years in which cholera is prevailing, the rise being due to the prevalence of certain predisposing influences in such seasons and to the erroneous registration of mild and sporadic cases of cholera under the less formidable name. In 1885 bowel-complaints proved most fatal in the months of January, July, August, November, and December, and least so in April and May. On the whole deaths from diseases of this class were more numerous than in 1884. They prevailed more or less in all the districts, but the mortality was greatest in Chingleput, Malabar, South Canara, Nilgiris, and Tinnevelly. The highest death-rate in any one circle was 4·1 in Chingleput, and the lowest 0·2 in Vizagapatam. The chief predisposing causes of bowel-complaints are general insanitary conditions, especially bad water and foul air; and the deaths under this head will no doubt diminish as the sanitary condition of towns and villages is improved.

In the city of Madras the death-rates from bowel-complaints during each of the past 5 years were 4·9, 5·3, 5·6, 6·4, and 7·0 in 1885, and the very large ratios during cholera years lead to the suspicion that here also a good many deaths from cholera are attributed to bowel-complaints. Still, making every allowance for errors of this kind, the mortality is excessive, and indicative of foul air, overcrowding, bad drainage, and, probably, in some cases the use of water polluted with sewage.

Injuries. The deaths from violence during the year amounted to 11,659 against 11,502 in 1884. They were in the ratio of 0·4 per 1,000 of population, and of the total, 1,573 were attributed to suicides, 901 to wounds, 6,815 to accidents, and 2,370 to snake-bites and the attacks of wild beasts. There was an increase under each of these heads except "accidents," and the rise may probably be ascribed to improved registration.

Vaccination.

The total number vaccinated in 1885 was 776,479 against 803,469 in 1884, showing a reduction of 36,990 in the year under review. Dr. Laing's explanation of the decrease is that owing to the great prevalence of small-pox in 1884, unusually large numbers were induced to submit to the operation, and that public alarm having passed away with the partial decline of the epidemic in 1885 fewer sought the benefit of the prophylactic. It also appears that the large numbers of re-vaccination operations done in Madras town in 1884 helped to swell the results in that year to an unusual extent.

There was a decrease in the out-turn of all establishments except dispensaries, and the increase under that head (1,047) was due to an arrangement by which the medical subordinates in charge of the institutions were required to undertake the whole of the vaccination work in the towns in which they were located. Although there were thus more operations done through the agency of dispensaries, there was in reality a decline in the total vaccinations as compared with the numbers which were accomplished when vaccinators also worked in the towns; and it has been arranged, in communication with the Surgeon-General, that the old system be again revived.

Under primary vaccinations there was a total decrease of 21,071, for which all establishments, except dispensaries, were more or less responsible. In re-vaccinations the decrease amounted to 15,919, and all establishments showed less work. The ratio of success in primary cases was 94·3 per cent. and in re-vaccination 57·4, which give a mean rate of 93·6, which may be regarded as very satisfactory. Both in primary vaccination and re-vaccination the greatest amount of success, viz., 97·3 and 86·6 per cent., respectively, was attained by Government vaccinators, and the lowest, viz., 60·9 and 37·4 per cent., by medical subordinates.

Of the total number vaccinated 142,115 were under 1 year of age, 384,007 over 1 and under 6, and 183,290 above 6 years; these figures give the following per-centages, viz., 18·8, 51·0, and 24·3 respectively. As usual, the greatest number of operations was performed on children over 1 and under 6 years of age. Contrasting these age results with those for 1884, they show increased activity in the vaccination of infants and children under 6, but a decrease in that on persons of ages above 6. Of the total number vaccinated, 54·6 per cent. consisted of males and 45·4 per cent. of females.

Animal vaccination was carried on in Madras town, Bellary, Harpanahalli, Cuddapah, Guntur, Kurnool, Madura, Chittoor, Salem, Negapatam, and Tanjore—in all 11 circles—and the results have been satisfactory. As in the case of human lymph, that from the calf is also most certain when used direct, but if this cannot be done it is best preserved on "points." It has the slight advantage of not keeping so well as humanised lymph and of not taking so certainly. As regards its effects, the vesicles and areola are almost exactly the same, and run the same course with the usual constitutional disturbance.

Sanitary Works.

Municipalities.

No new work of any importance was undertaken during the year. The water-supply of Old Town Cuddalore was considerably improved, and the town now enjoys a supply of good drinking water brought into it in open channels from the lakes at Mount Capper, and stored in reservoirs with filter beds. As usual, the sanitary works consisted in the improvement of town sites, in the cleansing and repairing of tanks and wells—some new wells also were sunk—and in the construction and repair of markets, slaughter-houses, latrines, dust-bins, drains, &c. The systems of conservancy and drainage, which in some towns are defective, and the sources of water-supply were the same as reported in former years. Surface cleansing appears to have had great attention paid to it, and the reports show progress in this respect. The system of private scavengering also appears to have been further extended, for, while in 1884 a total of 17,131 private latrines were cleansed by the municipalities, in 1885 there were 19,204 thus taken care of. This is a step in the right direction. The conservancy staff was larger than in the preceding year, and the strength varied in each town according to its requirements; except in some few instances, it seems to have been adequate generally.

The total estimated income of all the municipalities, Madras town excluded, for the official year 1885–86 amounted to Rs. 18,79,490, representing an incidence of Rs. 1-6-5 per head of population; the income for 1884–85 was Rs. 19,27,462, and the incidence

Rs. 1-7-3 per head, so that the income on the whole was less in 1885–86; and with the reduced income we find that the sanitary allotment for the year has also been curtailed; it has been reduced from Rs. 6,54,536 in 1884–85 to Rs. 5,91,071 in 1885–86, the difference being Rs. 63,465. Proportionally to income the allotment stands at 31·4 per cent. against 33·9 in the preceding year. Though less, it may be considered as adequate on the whole. Conservancy absorbed the greatest portion of it, viz., Rs. 3,81,826, or 64·6 per cent. The per-centages in each individual town ranged from 8·7 in Palghat to 63·8 in Ootacamund. Excepting Palghat 8·7, Ongole 11·3, Tellicherry 14·7, Erode 15·1, Mangalore 16·8, and Calicut 17·1, whose per-centages are low, the other towns have contributed a fair share out of their income for sanitation—some very liberally. In Palghat, Tellicherry, Mangalore, and Calicut the circumstances are such that not much is required for conservancy.

Of the total allotment of Rs. 5,91,071, there were spent in nine months, ending with December 1885, Rs. 4,21,768, leaving Rs. 1,69,303, or Rs. 21,535 more than one-fourth of the grant to be expended in the concluding three months of the year. The sanitary allotment for 1884–85 was Rs. 6,54,536, of which only Rs. 5,63,816 were spent in the whole year, thus allowing Rs. 90,720 to lapse without being expended.

District Local Fund Boards.

The Local Fund Boards are distinct from municipalities. They were, till 31st March 1885, regulated by the Local Fund Act IV. of 1871. In April 1885 a new Act, called the "Madras Local Boards Act V. of 1884," was introduced, which superseded it. By this enactment each of the 21 districts in the Presidency has been constituted a board in itself. Among other objects it provides, in regard to sanitation, for the improvement of village-sites and water-supply, for sanitary arrangements during fairs and festivals, for the scavengering of small towns and large villages, for the construction and repair of markets, slaughter-houses, latrines, dust-bins, and drains, and other measures calculated to promote the health, comfort, or convenience of the people.

The available income in which sanitation claims a share is one-third of land-cess. The income thus obtained during 1885–86 amounted to Rs. 13,77,113 against Rs. 14,02,971 in 1884–85, *i.e.*, it was less by Rs. 25,858 in the year under notice. Of this income, Rs. 3,41,504 were set apart for the sanitary objects noted above, being Rs. 31,442 less than the grant for 1884–85; thus it will be seen that the District Boards, like the municipalities with a reduced income, have made a smaller allotment for sanitation than in the preceding year. Proportionally to income the allotment stands at 24·7 per cent., which may be accepted as a fair share on the whole devoted to sanitation; but it invariably happens that the grant is not fully utilised. Thus in 1884–85, the figures of which represent the transactions for the whole year, out of a sanctioned allotment of Rs. 3,72,946 only Rs. 3,05,538 were spent, allowing Rs. 67,408 to lapse; in the year 1885–86, out of Rs. 3,41,504 only Rs. 1,95,660, or a little more than half, were expended in the nine months ending with December 1885, leaving Rs. 1,45,844, or very much more than one-fourth, to be spent in the remaining three months of the year. In no item of sanitation, not even conservancy, which is a fixed charge, was the sanctioned amount fully utilised in 1884–85. The per-centages varied in the several districts from 2·7 in Malabar to 40·7 in Bellary. Eliminating Malabar and South Canara for reasons set forth in previous reports, the per-centages in 9 districts were between 25·0 and 40·7; in 7 they ranged from 21·2 to 24·0; and in 3—Cuddapah (19·5), Ganjam (17·5), and Nellore (10·3)—they were very low. In keeping with the low per-centage in Nellore, the sanitary condition of the towns and villages in the district have been unfavourably reported upon by the district medical and sanitary officer.

From 25 to 30 per cent. of available income is the fixed allotment that should be made for sanitation, but some districts contributed a larger share of their income towards this object than the amount fixed, viz., Bellary 40·7, Nilgiris 39·0, Coimbatore 36·9, South Arcot 36·4, Salem 35·9, Tanjore 35·7, and North Arcot 31·3. Two districts—Godaveri and Anantapur—were within the mark, and allotted 27·6 and 25·0 per cent. respectively, while in the remaining districts the allotments fell short of the fixed per-centage; in some slightly, as Kistna 24·0, Kurnool 23·5, Tinnevelly 23·3, Trichinopoly 23·0, and in some, as noted above, very much, viz., Cuddapah 19·5, Ganjam 17·5, and Nellore 10·3.

Water-supply, Drainage, and Conservancy.—The sources of water-supply and system of drainage and conservancy were the same as those described in former reports. Improvement of water-supply now receives greater attention year after year, as is evidenced by the increased outlay for this object; in 1883–84 the amount sanctioned under this head was Rs. 84,581, in 1884–85 it was Rs. 85,340, and for 1885–86 it rose

to Rs. 91,640. Scavengering establishments were maintained in small towns and large villages adjoining the head-quarter stations, from where supervision can more properly be exercised. Generally speaking they are of some service so far as surface cleansing is concerned, but the greatest evil to cope with is the conservancy of the interior of private dwellings where sanitation has yet to make its way in. In some few districts the establishments are too small and supervision imperfect to be of any practical value. In a few districts sanitary associations are formed in some of the larger villages, who supervise the scavengering and other sanitary operations. Contributions are raised from the people for the purpose, which are supplemented by an equal amount from the General Local Funds. The number of towns and villages in all the Local Fund districts was 51,930, and of these 557 were conserved during the year under notice against 565 in 1884–85. In 10 districts increased exertions are observable in this respect, notably so in North Arcot, in which the conserved villages were increased in number from 18 in 1884–85 to 29 in 1885–86. In 4 districts—Godaveri, South Arcot, Madura, and Coimbatore—a retrograde movement has been made in this direction, especially so in Coimbatore, where the number of conserved villages fell from 35 to 10 in the year under report. In South Arcot the number was reduced by 9, and in Godaveri by 4, and in Madura by 3.

General Remarks.

Having taken over acting charge of this office only on the 14th April 1886, it falls to me merely to insert the following notes of my predecessor, Surgeon-General George Bidie, C.I.E., under this section :—

During part of January and throughout February I was in charge of the office, but was again relieved in March and did not take permanent charge till the 8th April. In February, at the request of His Excellency the Commander-in-Chief, a visit was paid to Secunderabad, with the object of reporting on certain proposals to improve the drainage and water-supply of the native town there. The quarters occupied by the Divisional staff as well as those of some other officers are close to the bazaars, and both are situated immediately on the margin of the Hussain Saugar tank, to which a large portion of the native community resort for their water-supply, and which at the same time receives the whole of the sewage of the town. When visited by me the tank was low, and, between it and the houses, there was a considerable extent of low ground, by no means clean and subject to periodical submersion and drying up. Across one corner of this, near the staff lines, a wide channel conveyed the town sewage in a black, seething stream till lost in the water of the tank. The smell from this current was simply overpowering, and was said to frequently induce nausea and vomiting amongst the tenants of the staff lines. In short the whole arrangement is most disgusting, and a standing menace to the health of the troops in this very large cantonment. To remedy this state of affairs, Major Fox, R.E., the local Executive Engineer, drew up a scheme, the main feature of which is an intercepting sewer that would keep the sewage out of the tank and convey it to an irrigation nullah which waters a considerable acreage of rice land below the tank. Regarding the latter part of the scheme, I was obliged to raise certain objections, as it appeared to me that proper arrangements were not provided for the final disposal of the sewage, and that in consequence a fresh nuisance would probably be created. The advice given was in harmony with the most approved arrangements existing at home for the utilisation and purification of sewage. Major Fox proposed to further protect the health of the inhabitants by the introduction of a copious supply of water, to be collected at a considerable distance from the cantonment on clean and mostly uncultivated pasture land. The details of this scheme had not been worked out at the time of my visit, but its general features were approved.

Owing to the great success of the artesian wells in Pondicherry, attempts were made in the same direction in other stations on the Coromandel coast, but in no case did they succeed.

The Red Hills tank, which furnishes the water-supply of Madras city, was breached during a cyclone in the end of 1884, and advantage was taken of the resulting low level of the water to erect a water-tower, by means of which the surface water can be drawn off till the tank is nearly empty. The huge breach in the embankment was also duly repaired.

With reference to the animadversions of the Army Sanitary Commission on the health of prisoners in jails, it was recommended that quarterly rough analyses of the

water-supplies of prisons should be made by the medical officers in charge, with the view of detecting the slightest approach of danger in that direction. This suggestion met with the approval of Government.

In consequence of the continuous and widespread prevalence of cholera, a series of simple rules to be observed during the advent and prevalence of the disease was circulated to local authorities.

The inhabitants of Dindigul started a highly commendable experiment for the supply of water to the town by pumping with machinery from a well and delivery through pipes, but unfortunately the water turned out to be of bad quality. It is believed, however, that a supply of good potable water can be got from a neighbouring river. At Madura also a similar experiment was successfully inaugurated, but the water in this case was of fair quality, being derived from perennial springs in the bed of the river.

The Master Attendant at Madras referred the question as to whether shipment of salt-fish and hides stowed in the 'tween decks of coasting steamers carrying native passengers is deleterious to health. Instead of laying down a hard and fast rule, it was pointed out that when such articles are considered dangerous, they can be dealt with by the Port authorities under the Native Passenger Act No. VIII. of 1876, and in case of any doubt the opinion of the local medical officer can always be got, so that each case may be dealt with on its own merits, and unnecessary and vexatious restrictions to commerce avoided.

The Government had under consideration the very important question of private house scavengering by municipal agency in towns, and a good deal of valuable information on the subject was communicated to them by various Presidents of Municipal Commissions. Government finally decided that "the real secrets of a successfully-worked system seem to be effective arrangement, a low scale of fees, and a vigorous prosecution in cases where, under private management, latrines and drains are not kept in proper order." Considerable progress was made in this important part of conservancy in 1885.

During my inspection tours the need for a sanitary engineer specially qualified to give advice to local bodies with regard to water-supplies and drainage was frequently impressed on me, and there seems strong reason to believe that, if such an authority were available, a great impetus would be given to sanitary works. Many municipalities are at present deterred from entering on such projects for the want of a thoroughly qualified sanitary engineer, who would assist them in carrying out schemes of improvement at a practicable cost. The subject was referred to Government after the close of the year and will be more particularly alluded to in next year's report.

Another very important subject, which was brought home to me while touring, was the great neglect of sanitation in colleges and schools, and the detrimental effects which such negligence is likely to have on the general health, mental and bodily vigour, and eyesight of the rising generation. It is hopeless to expect improvements in domiciliary sanitation without the aid of the schoolmaster, and if his teachings are not backed up with practical lessons in such simple matters, as the use of latrines and urinals, they will not be of much value. Hitherto the sanitary department has had no authority to inspect educational institutions, and it was therefore resolved to address Government on the subject. Subsequent to the end of the year the whole matter was put on a satisfactory footing and will receive due notice in next annual report.

Some of the points which appear to require special attention in the operations of the sanitary department in future years are as follows :—

(*a.*) Town refuse should, as far as possible, be burned to avoid cost of transport to a distance, and also the risk of air and water pollution by the storage of collections of decomposing organic matter.

(*b.*) Cattle are usually housed in confined buildings in back-yards, without any regard to ventilation and cleanliness, so that not only is the health of their owners but also that of the beasts impaired. This question has also another important bearing with reference to the quality of the milk supply. As milk forms so important an item in the dietary not only of the young but also of many adults, no effort should be spared, to carry out improvements in the housing of cattle.

(*c.*) Steps should also be taken to impress on the people the importance of better sanitation in their private houses, as, in the absence of this, municipal sanitary improvements will be of little avail. The great defects are overcrowding, neglect of ventilation, imperfect conservancy, and pollution of water-supply.

Not only is it important to remove fæces but also to make some arrangement for the disposal of urine. In the urine passed daily by each adult the solid constituents amount to about 1·735 ounces, most of which are at present allowed to sink into the ground and defile it. It follows, therefore, that in nearly all native towns there is a strong urinous smell, most offensive and most pernicious.

(*d.*) The great density of the population in parcherries and poor neighbourhoods is one potent cause of the persistent high death-rate in towns, in spite of general improvements. Owing to the miserable nature of the dwellings and the way in which they are packed on the ground, sanitary improvements are almost impossible, and such quarters, therefore, remain foul and unhealthy, inviting disease. The attention of municipalities should be steadily directed to the importance of regulating the location of dwellings so as to obviate overcrowding and facilitate conservancy, and efforts should be made to provide new sites and disperse the population in overcrowded localities. In various quarters of Madras city the population is housed in the proportion of from 104,000 to over 198,000 per square mile.

(*e.*) Greater care should be exercised in the inspection of cattle and sheep before being killed for food.

(*f.*) It is believed that at present in many towns the inspection of articles of food sold in small bazaars chiefly patronised by the poor is very lax, so that unwholesome meat, fish, fruit, vegetables, and grain are sometimes sold.

(*g.*) At present the Sanitary Commissioner annually inspects as many of the municipalities as possible, but it would be more to the purpose, I think, if he visited fewer towns and reported thoroughly as to the sanitary defects and requirements of one or two. Government and the local authorities would thus know exactly the state of such towns, and be able to note the rate of progress in sanitary improvement.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1885.

Deputy Surgeon-General T. G. Hewlett.)

Vital statistics.

In the Presidency of Bombay, including Sind, during the year 1885 the births of 298,406 males and 274,025 females, or a total of 572,431 children, were recorded against 278,986 boys and 255,737 girls, or a total of 534,723 children in 1884. The recorded births for 1885 were thus 37,708 in excess of those for the previous year, whilst they exceeded the mean of the preceding 10 years ending 1884 by 183,681.

The following table shows the number of births registered in each year from 1875 to 1885, their ratios per 1,000 of population, and the proportion of males to females:—

Years.	Number of Births Registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1875 - - -	178,892	161,937	340,829	11·05	10·01	21·06	52·49	47·51	90·52
1876 - - -	181,872	163,612	345,484	11·24	10·11	21·35	52·64	47·36	89·96
1877 - - -	164,262	147,399	311,661	10·15	9·11	19·26	52·75	47·25	89·73
1878 - - -	128,848	114,405	243,253	7·96	7·07	15·03	52·97	47·03	88·79
1879 - - -	151,460	136,410	287,870	9·33	8·41	17·74	52·61	47·39	90·06
1880 - - -	195,285	175,588	370,873	12·03	10·82	22·85	52·66	47·34	89·91
1881 - - -	239,912	219,745	459,657	14·58	13·35	27·93	52·19	47·81	91·59
1882 - - -	255,927	235,419	491,346	15·55	14·31	29·86	52·09	47·91	91·98
1883 - - -	261,966	239,835	501,801	15·92	14·58	30·50	52·20	47·80	91·55
1884 - - -	278,986	255,737	534,723	16·96	15·54	32·50	52·17	47·83	91·67
Mean for 10 years	203,741	185,009	388,750	12·48	11·34	23·82	52·41	47·59	90·81
1885 - -	298,406	274,025	572,431	18·14	16·65	34·79	52·13	47·87	91·83

It is satisfactory to notice the progressive improvement that, except in the three years of famine, has taken place in the registration of births.

The number of births recorded in 1885 was higher in each of the districts than that recorded in the previous year, except in Sind, in which the number (48,759) was lower by only 42 than in 1884 (48,801). The total increase for the Presidency was 10·97 per 1,000 of population above the mean of the preceding 10 years, and the number of recorded births in 1885 was higher than in 1884 in all the 24 collectorates, excepting Thana, Karachi, Shikarpur, and Upper Sind Frontier.

The extremely defective state of the registration of births in the City of Bombay, and the steady decrease year by year since 1880, was noticed in last year's report. In 1885 there was a slight increase of 308 in the number of births (14,685) over the number registered in 1884 (14,377). The measures taken by the Municipal Commissioner to secure a correct registration of births are evidently inadequate for the purpose, and as it is one of importance, I hope Government may be pleased to call his especial attention to the subject, as it is certainly not right that the leading municipality in this Presidency should occupy such a very low place on the list of towns as regards registration of births.

The recorded birth-rates among the urban and rural populations of the Presidency were respectively 26·17 and 39·90 against 25·53 and 33·52 in 1884. The birth-rates recorded among the rural population of each collectorate, except Ratnágiri, Kánara, Ahmedabad, Karáchi, and Hyderabad, were higher than the birth-rates registered in the urban circles. In 1884 the same fact was observed in the above collectorates.

Out of 55 towns in the Presidency only 10 returned a birth-rate exceeding 40 per 1,000. In 1884 there were 12 towns in which the recorded birth-rate was over 40 per 1,000. An improvement is noticed in some of the towns, especially Poona, which

returned a birth-rate of 29·36 against 15·88 in 1884, but it is evident that this important subject was much neglected, and, singularly enough, as pointed out last year, in the head-quarter towns, where one would have supposed the wishes of Government would have been more strictly attended to. For example, in the town of Sholápur, a birth-rate of only 19·95 per 1,000 against 19·49 in 1884 was recorded, in the town of Násik the birth-rate was 15·89 against 17·59 in 1884, and at Thána 11·41 against 15·98 in 1884. I hope that Government may be pleased to point out to the Municipalities which have returned such low birth-rates that they are not performing their duty properly by such neglect, and to impress on them the absolute necessity of much greater attention being paid to this most important subject.

In 1885 among the civil population in the rural, town, and cantonment circles of the Presidency of Bombay the deaths of 248,829 males and 224,762 females, or a total of 473,591 persons, were recorded. In the previous year 408,409, or 65,182 less than in 1885, were registered. The following statement shows the number of deaths registered in each year since 1875 :—

1875	-	375,718	1879	-	387,542	1883	-	420,198
1876	-	368,260	1870	-	328,673	1884	-	408,409
1877	-	627,708	1881	-	381,450	1885	-	473,591
1878	-	532,951	1882	-	343,418			

excluding the famine years 1877–78, the recorded deaths in 1885 were more numerous than in any year of the series.

The computed death-rate per 1,000 of population in 1885 was 28·78 against 24·82 in 1884, and a decennial mean of 25·58. Omitting Sind, where the mortuary registration is extremely defective, the recorded death-rate in the other parts of the Presidency amounted to 30·34 per 1,000 of population.

The millesimal ratio of males dying to males living was 29·28, and of females dying to females living 28·25. In 1884 these ratios were respectively 25·23 and 24·39. For every 100 females who died, 110·71 deaths among males were registered, but these proportions vary considerably in some of the Collectorates.

The mortality amongst infants under 1 year (100,609) and children above 1 year but under 5 (99,639) was, as usual, terribly high in comparison with other periods of life. In fact, the deaths in children under 5 years of age formed 42·28 per cent. of the total deaths. As pointed out last year, the extremely high rate of mortality among children of tender years affords unmistakeable proof of local causes of insanitation throughout the Presidency. The period of greatest immunity was in the age of above 10 and under 15, the rate being 7·08 per 1,000. For those "above 60 and upwards" the mortality was at the rate of 76·73 per 1,000. The per-centage on total deaths amongst infants under 1 year is 21·24 against 23·79 in 1884. For those above 1 and under 5 the per-centage on total deaths was 21·04 against 21·28 in 1884. For old people above 60 and upwards the per-centage on total deaths was 12·03 against 10·66 in 1884.

The subjoined table shows the deaths in 1885 arranged according to the specified causes laid down by the Government of India and contrasted with the results for 1884 and the mean of the preceding 10 years :—

Causes of Deaths.	Mean for 10 Years, 1875–84.		1884.		1885.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera - - -	26,765	1·64	13,804	0·84	37,287	2·27
Small-pox - - -	7,923	0·49	14,438	0·88	2,646	0·16
Fevers - - -	272,712	16·71	276,989	16·88	314,237	19·10
Bowel complaints - -	34,952	2·14	35,983	2·19	45,056	2·73
Injuries - - -	6,384	0·39	5,570	0·34	5,577	0·34
Other causes - - -	68,697	4·2	61,625	3·74	68,788	4·18
All causes - -	417,433	25·58	408,409	24·82	473,591	28·78

Cholera.

During 1885 cholera caused 37,287 deaths throughout the Presidency, or 23,483 more than in the preceding year, but 667 less than in the year 1883. The epidemic was most severely felt in the Sind Registration District, as 11,719 persons, or 4·85

per 1,000 of population, died; whilst the minimum mortality took place in the Eastern Gujarát Registration District, in which there were 1,539 deaths, or 0·54 per 1,000 registered. No collectorate of the Presidency was exempt during the year under report.

Out of 37,287 deaths registered during the year, 20,527 occurred among males and 16,760 among females, so for every 100 deaths among males there were 82 deaths among females. The ratio per 1,000 of males dying to males living was 2·42 and of females dying to females living 2·16. Last year they were 0·88 and 0·80 respectively. The deaths among females exceeded those among males in the Ratnágiri and Surat Collectorates, whilst in the remaining zillas the reverse was the case.

The total cholera mortality was distributed over 3,776 registration units, viz., 38 towns, 5 cantonments, and 3,733 villages. Out of the entire population (16,454,414) of the Presidency, 4,840,783 persons, or 29·42 per cent., were living in the affected localities. Of these, 37,287, or 0·77 per cent., died. Out of 40,894 inhabited villages in the Presidency, 3,733, or only 9·13 per cent., were affected with cholera.

In the Sholápur Collectorate there are 709 villages, of which 202, or 28·49 per cent., were affected. In the Belgaum, Sátára, Karáchi, and Poona Collectorates the per-centages were 21·25, 20·67, 20·25, and 20·07 respectively, whilst in the remaining collectorates they were below 13.

In conclusion, putting aside for the present all questions as to the etiology of cholera, the lesson to be learnt from this epidemic is that all measures taken at the time of an outbreak of cholera can only be palliative. The real remedy is to insist on sanitary measures being introduced so as to ensure cleanliness in every village at all times irrespective of epidemic times or seasons. If this were only understood and acted upon cholera and other diseases would lose their intensity, but nothing short of this action will prevent epidemics.

Small-pox.

During 1885 the deaths from small-pox of 1,364 males and 1,282 females, or a total of 2,646 persons were recorded against 14,438 in 1884 and a decennial mean of 7,923. The disease was present in all the districts, but none in an epidemic form. The highest ratio, 0·32, was recorded in the Southern Registration District against 2·90 in 1884 and a decennial mean of 0·60. In the Sind Registration District there was a ratio of 0·22 against 0·43 in the previous year, and 0·21 the decennial mean. In the Central, Western, and Eastern Gujarát Registration Districts, the ratios per 1,000 of population were respectively 0·13, 0·12, and 0·06.

According to age 22·0 per cent. of the deaths occurred among infants under 1 year of age, whilst 32·7 per cent. took place among children over 1 and under 12, the remaining 45·3 per cent. being among persons over that age.

Fever.

During 1885, 163,561 males and 150,676 females, or a total of 314,237 persons were reported to have died from fever. The increase, therefore, for the year under report, as compared with 1884, amounted to 37,248 deaths, the mean for the previous 10 years being 272,712.

In all the districts excepting Sind fever caused a higher mortality during the year than in 1844. In the Eastern Gujarát Registration District the fever death-rate was the high one of 25·97 per 1,000 of population against 22·72 in 1884 and 21·62 during the previous 10 years. In the Central Registration District the ratio was 20·06 against 16·40 in 1884 and 15·71 the decennial mean. In the Western Registration District the ratio was 18·96 against 16·19 in the previous year and 16·27 the mean for the last 10 years. The ratio in the Southern Registration District was 16·14 against 14·47 and 18·34 respectively in the previous year and the mean. In Sind Registration District the ratio 12·90 was less than the ratio 14·47 in 1884, but it was slightly higher than the mean 11·13.

The death-rate from fever in the urban population amounted to 14·74 per 1,000 of population against 13·83 in the previous year, but among the rural population it amounted to 19·74 against 17·27 in 1884. This fact was brought forward in my last two reports as proving the necessity for improving village sanitation.

The highest death-rate from fever is reported to have occurred at Nadiád, a town in in the Kaira Collectorate, where it attained the enormously high rate of 42·65 per 1,000 of population against a zilla rate of 27·66. In only 14 towns and cantonments situated in 10 different collectorates, excluding the city of Bombay, the death-rate from fever was higher than the average death-rate of the zilla.

During 1885 bowel complaints caused the deaths of 24,522 males and of 20,534 females, or a total of 45,056 persons against 35,983 in 1884 and a decennial mean of 34,952. The Southern Registration District heads the list with the very high ratio of 4·83 per 1,000 of population against 4·20 in 1884 and 3·56 the decennial mean. Gujarát comes next with a ratio of 2·91, and next to it is the Western Registration District, 2·81, and following it is the Central Registration District, 2·57, and the last of all Sind with a rate of 0·28 per 1,000. In the Presidency the rate was 2·73 against 2·19 in the previous year and a decennial mean of 2·14. All the districts show an increase in the death ratios. Bowel complaints.

During 1885, 3,158 males and 2,419 females, or a total of 5,577 persons met with violent deaths. The mortality from these causes is only 7 more than in 1884, when 5,570 deaths were reported. Of the 5,577 deaths 2,427 were caused by drowning, 1,100 resulted from snake bites, 502 from wounds, 236 by hanging, 162 by poisoning, 110 from attacks by wild beasts, and 1,040 from causes not specified. Injuries.

The recorded deaths from causes other than those specified numbered 68,788, 35,697 of which occurred among males and 33,091 among females. The total for 1884 was 61,625; so for this year there is an increase of 7,163. Other causes.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1884–85:—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1884-85.	1885-86.	Increase.	Decrease.	1884-85.	1885-86.	Increase.	Decrease.	1884-85.	1885-86.	Increase.	Decrease.
IN CIVIL LIFE.												
Itinerant	774,311	803,763	56,452 7·29	—	59,999	51,839	—	8,160 13·60	834,310	882,602	48,292 5·79	—
Dispensary	24,014	20,298	—	3,716 15·47	1,780	761	—	1,019 57·25	25,794	21,059	—	4,735 18·36
Total	798,325	851,061	56,452 7·07	3,716 0·47	61,779	52,600	—	9,179 14·86	860,104	903,661	48,292 56·15	4,735 0·55
IN ARMY LIFE.												
Native Army	3,554	3,120	—	434 12·21	1,435	681	—	754 52·54	4,989	3,801	—	1,188 23·81
British Army	328	206	—	122 37·20	147	122	—	25 17·01	475	328	—	147 30·95
Total	3,882	3,326	—	556 14·32	1,582	803	—	779 49·24	5,464	4,129	—	1,335 24·43
Total for the whole Presidency.	802,207	854,387	56,452 7·04	42·72 0·53	63,361	53,403	—	9,958 15·72	865,568	907,790	48,292 5·58	6,070 0·70

Eight hundred and fifty-four thousand three hundred and eighty-seven persons were primarily vaccinated and 53,403 were re-vaccinated against 802,207 and 63,361 in 1884–85, showing a net increase of 52,180, or 6·51 per cent., under primary vaccinations and a net decrease of 9,958, or 15·72 per cent. under re-vaccinations. The rate of decrease in primary vaccinations was very high amongst British troops, being 37·20 per cent., and in re-vaccinations it was very high amongst dispensaries, being 57·25 per cent. The highest decrease (30·95 per cent.) under total operations was amongst British troops. On the whole, there has been an increase of 42,222, or, in other words, for every hundred persons operated on in 1884–85 the numbers for this year have been 104·88.

This year the successful vaccinations fell short of the registered births *minus* deaths amongst those under one year old, and yet the number vaccinated is greater than that for the previous year. Out of 471,822 infants available for vaccination 363,519 or 77·05 per cent. have been protected. Last year the per-centage was 75·11.

Out of 854,387 persons primarily vaccinated 818,135 cases were successful or 95·76 per cent., being 0·47 per cent. more than in 1884–85. The number of unsuccessful cases was less than that in the preceding year, being 15,891 against 18,948. 2,193 persons were operated on a second time on account of the failure of the first operation, and in 22,554 cases the result was unknown. During the year 53,403 persons were re-vaccinated against 63,361 for 1884–85. In 46 instances the re-vaccinations were repeated, in 6,405 instances the result could not be ascertained, and in 10,853 the operations failed. The number of successful cases was 36,191 or 67·77 per cent. against 65·11 in the preceding year. The total number of persons operated on was 907,790, and of these 854,326, or 94·11 per cent., were successful. In 1884–85 the per-centage was 93·08. 2,239 persons were operated on more than once; the "unsuccessful" numbered 26,744 and the "unknown" cases were 28,959.

The ratio to the total population of protection by successful operation is higher than last year in all the districts and circles. It was lowest in Western Registration District and Presidency Circle. In British and Native territory it was respectively 31·94 against 30·14 and 29·30 per 1,000 of population in the previous year. On the whole 31·94 persons of all ages per every 1,000 of population against 29·84 last year, 30·89 in 1883–84, 29·74 in 1882–83, 27·54 in 1881–82, and 24·00 in 1880–81, were primarily vaccinated successfully.

In primary vaccinations the per-centages were higher than in the preceding year in Local Fund and Native State establishments, and in dispensaries and the Native army. The highest per-centage was 96·39 under Local Fund and the lowest was 91·26 in the British army. The next highest is 95·78 in Municipal and the next lowest is 91·88 under Government. In re-vaccinations the lowest per-centage is 50·81 in cantonments and the highest was 88·60 under Government.

The age details are compiled for three periods, viz., under one year, between one and six, and above six years. The numbers under each period primarily vaccinated were respectively 587,894, 253,927, and 12,566 against 525,905, 257,938, and 18,364 during the preceding year. At the rate of 31 per 1,000 of population, and on the total population of 25,615,528, there were successfully vaccinated 71·16 out of every 100 infants against 63·41 in 1884–85, 61·00 in 1883-84, 59·01 in 1882–83, 58·35 in 1881–82, 49·27 in 1880–81, and 39·78 in 1879–80. Thus each year is characterised by progress in the protection afforded to infants.

Animal vaccination was carried on in Bombay, Poona City and Cantonment, Broach Collectorate, and Rájkot. The operation of inoculating heifers was generally successful. In Western Gujarát animal vaccination was, in the commencement of the cold weather, carried on in Rájkot by the Assistant Superintendent of Vaccination, who successfully inoculated six heifers and distributed the lymph among the vaccinators. Except in Bombay, where animal lymph only is used, and in Poona, Broach, Anklesvar, Jambusar, and Rájkot, where both animal and human lymph were in use, vaccination in all other places was carried on from arm to arm and with human lymph. Vaccination with animal lymph was also carried on in Bandora.

Taking together the work of all the Deputy Sanitary Commissioners, Superintendents of Vaccination, Assistant Superintendents of Vaccination, and Inspectors of Sanitation and Vaccination, there were 4,188 encampments, 80,105½ miles travelled in 8,364 days and 315,207 children inspected in 13,507 villages. Out of every 100 persons operated on, 34·72 were this year inspected against 38·44 in the preceding year.

In Bombay the Compulsory Vaccination Act has been in force for eight years and in Karáchi for six years, and in both places there has been, since the introduction of the Act, a considerable increase in the number of infants protected.

Sanitary Works.

Military Works.

The actual outlay on sanitary works (military) amounted to Rs. 1,63,233 during the year 1885. Of this sum Rs. 56,081 were spent at Bombay and Colába, of which Rs. 42,983 were for constructing quarters for officers in the Marine Lines: this work is still in progress. At Ahmedabad Rs. 64,477 were expended, of which Rs. 63,773 were for a hospital for British troops; this work was commenced in 1881 and has been completed, with the exception of some subsidiary buildings. The hospital has been handed over to the medical authorities for occupation. At Karáchi Rs. 15,953 were expended, of which Rs. 13,270 were for constructing quarters for the Sappers and Miners employed on the Submarine Mining Defences at Manora, and Rs. 1,998 for constructing quarters for the medical subordinates attached to the Native infantry hospital.

Civil Works.

The total annual income of the municipalities during the year 1884–85 was Rs. 30,70,624, and the sum expended on conservancy by them was Rs. 6,83,668.

The details of income and expenditure on conservancy in each revenue division will now be given :—

Divisions.	Annual Income.	Expenditure on Conservancy.	Divisions.	Annual Income.	Expenditure on Conservancy.
	Rs.	Rs.		Rs.	Rs.
Northern Division -	8,60,257	2,21,066	Southern Division -	3,19,942	1,02,079
Central Division -	9,16,931	2,26,706	Sind Division - -	9,73,494	1,33,817
			Grand Total -	30,70,624	6,83,668

Water-supply.—The existing arrangements are almost the same as those of last year. The supply is mainly from rivers, tanks, and wells. In Sind Division canal water is used for drinking purposes in several towns. At Ahmedabad the water is raised daily from the Sábarmati River by steam pumps. The spot from where the water is raised, is at the lowest point of the town and after the river has been fouled by washing clothes, &c. It is under consideration to remove the water-works to a spot above the town. Colonel Ducat, the Consulting Sanitary Engineer, visited the town and submitted a report containing proposals for a new system of water-supply. At Gogha the Sonoria tank is the chief source of water-supply; it is situated N.N.W., and about a mile from the town; the water is brought by a pucka closed channel to a masonry reservoir situated in the centre of the the town. At Dákor there is a fine tank, the water of which is excellent; but washing and bathing in it is permitted, and this should be discouraged. At Broach and Surat the water-supply is insufficient. At Thána there is a fair supply of water; it is brought from Pokharan tank. At Bándra the supply is obtained from Vehár Lake. Máhím gets its supply from Ranjani tank, which is about a mile from the town. At Kúrla the water-supply is indifferent in quality: the waters in most of the wells are impure, and they run dry during the hot season.

At Bhiwndi the water is brought by pipes from the Warala Lake. The town of Alibág obtains its supply from Weshwi tank, about two miles from it; the water is brought by iron pipes. At Roha the waterworks were completed during the year; the water is brought from a tank about five miles from the town. At Ahmednagar the Sub-Committee, appointed to report on the best means of improving and increasing the water-supply, have submitted their report, but the scheme has not yet been taken up. At Bhingár the water is brought by an aqueduct from springs in the hills, and is distributed in the town by nine tanks. Sangamner gets its supply from the river Pravára. Dhulia is mainly dependent on the river Panja for its water-supply. Málegaon for eight months gets its water-supply from the river Mosam; during the hot season the supply fell short, and the municipality had a dam of sand and earth erected across the river, and temporary wells were dug below the dam: peons were employed to see that the water was not fouled. At Násik the water-supply is derived chiefly from the river Godávari. At Igatpuri the drinking water is obtained from the railway bund; it is brought by pipes to seven stand-pipes. At Yeola the water-supply is insufficient. Poona City gets its water-supply from four aqueducts and the Khadakvásla canal. The supply is about 1,500,000 gallons per day, or about 15 gallons per head of population.

Poona (suburban municipal town) obtains its supply from the Khadakvásla canal and Mula and Mutha rivers. Lonávla receives its drinking water from the G. I. P. Railway Company reservoir at Buslia: about 2·4 gallons per head are supplied per day from the reservoir. At Khed the chief source is from the Bhima river: a peon is entertained during the hot season to see that the water is not fouled. At Malcolmpeth the water-supply is obtained from the Yema Lake, the Bishop's and Elphinstone tanks, and from several wells. At the end of every hot season the tanks and wells are cleaned. The Ekruk tank supplies Sholápur with pure drinking water. At Athni the Kumbhar well was deepened and improved at an outlay of Rs. 698, and an old well in the town was also improved at a cost of Rs. 2,351. At Karáchi the water-works were extended and completed during the year. The secretary of the municipality states that the supply of Malir water, both as regards quality and quantity, has more than realised the sanguine expectations that were indulged in when the scheme was initiated. At Hyderabad, 11 private water services were put up during the year. At Sukkur the chief source of supply is from the river Indus. The water is muddy. Colonel Ducat has proposed that water should be pumped from a well, to be sunk on the northern end of the island of Bukkur, which would yield an unlimited supply of pure water.

Drainage.—In all the towns there are open masonry side drains to the principal roads and mere earth trenches to others to carry off rain water, but there are no proper drains to carry off foul water from private houses. At Ahmedabad City there are no underground sewers to carry away urine, foul water, and nightsoil. A portion of the liquid sewage is collected in troughs and conveyed by municipal servants to the sewage depôts, but the greater portion of this liquid finds its way into pits ("Khalkuva," a description of this was given in the Sanitary Commissioner's Report for 1883, Section V., page 2, under cesspools,) made by the people under or at the side of the houses. There are about 6,941 such pits in this city. At Dholka town a large drain was cut. At Kaira there are underground drains in five main streets. At Surat

City there are about 8,060 cesspits (khalkuvas). At Ahmednagar both the surface water and the underground drains of the city are very defective. At Sangamner there is a main drain of masonry from Wamborkar's Wada to the Mahulungi river; there are, besides, branch drains connected to the main one. At Dhulia there are closed drains, and they are opened and cleaned once a year. At Násik two new drains were constructed and 15 drains were cleaned. In Poona City there are some old sewers which carry sullage water, which is discharged into the river on the north-east of the city. The sullage of the undrained part of the city is either collected in cesspools or carried in open road-side pucka built drains. At Sholápur there are four underground drains, two of which have their fall to the north, one to the west, and the other to the east. The civil surgeon of Sukkur says: "The present system of drains at Sukkur, without "provision for flushing them as occasion may require, is most dangerous to the public "health, and is already a constant cause of complaint by the inhabitants of New "Sukkur." Colonel Ducat visited Sukkur at the close of the year, and made proposals for remedying, as far as possible, the present defective system of drains.

Cesspools.—There are but few municipal cesspools, but most of the private houses have them, and the owners see to their cleanliness. In some of the towns the construction of new ones are discouraged. At Viramgám there are two municipal cesspools. At Ránder there are about 787 cesspools which are cleaned periodically by the municipality. At Shirpur there are about 78 cesspools to private houses; these are cleaned by municipal servants. At Násik, after the close of the rainy season, open cesspools were dug along the river bank from Janappá's Gate to Ballaji's temple to receive the drainage of that section of the city. The sewage from the other part of the city is brought by drains to Nav Gate, and the sewage from this point is carried by means of iron pipes across the bed of the river to a length of about 100 feet, and from these by an open channel to a length of about 500 yards below the town. The provision of a new water-supply and sewerage scheme at Násik is a matter of most urgent importance which has frequently been brought to the notice of Government. At Sholápur the municipality remove the filthy water from the cesspools in cylindrical carts to a distance of about half a mile from the town. Since the construction of the open surface drains the number of cesspools is steadily decreasing. At Shikárpur those under the control of the municipality are kept fairly clean, and are deodorised with quicklime.

Scavengering.—A staff of sweepers is entertained by each municipality to keep the town and streets clean. In most of the towns dust-bins are placed in suitable places, which are emptied once a day. The street sweepings are either sold, burnt, or used for filling up hollows. At Gogha and Anklesvar this work is done by contract. At Thána the street sweepings are taken to the Band Creek and spread on the reclaimed ground. At Karáchi a light tramway for the removal of street sweepings was laid down during the year, and will be in thorough working order in a short time. At Tatta the work is done by contract.

Latrines.—The majority of municipal towns have public latrines. Private privies at some of the towns are cleaned by municipal sweepers. At Ahmedabad City the night-soil is removed in covered tram cars to a distance of 2½ miles. At Dákor town there are 10 fields set apart as latrines. At Broach City there are no regular built public latrines: open enclosures are allotted to the public to resort to. At Karáchi new latrines were erected. At Athni two sets of latrines were constructed at a cost of Rs. 927. The night-soil from the latrines is carted to depôts about a mile or two from the towns, and is either buried or converted into poudrette.

New Works.—At several places large sums were expended on new sanitary works, details of which are given in the Sanitary Commissioner's report.

Personal Proceedings and General Remarks.

In the commencement of the year I visited the cities of Surat, Broach, and Ahmedabad, and in February proceeded to Karáchi, Jacobabad, and Quetta, on which cantonment I submitted a special report. I passed May at Mahábaleshvar, and went to Poona for June, but in July proceeded in company with the Inspector General of Prisons to Ahmedabad for the purpose of selecting a fresh site for the new jail. In August I visited Násik and Mhow on inspection duty, and in September went home on three months' privilege leave. Surgeon-Major MacRury acted as Sanitary Commissioner, in addition to his own duties, during my absence. On my return journey I rejoined my appointment, by permission of Government, at Aden, and submitted an inspection report on that settlement. I arrived in Bombay on the 29th December.

At Surat I was accompanied, during my sanitary inspection, by the Municipal Commissioners, and afterwards had the pleasure of meeting them in the Municipal Hall, where I explained to them the very unsatisfactory state of the town as revealed at the inspections. This ancient city is riddled with khalkowas, and the great need for a fresh-water supply and a sewerage scheme is manifest; but when I advised them to apply to Government for the services of the Consulting Sanitary Engineer, I received a reply to the effect they could not afford to pay for his services.

The city of Broach, too, was found to be in a most insanitary condition. This fact was acknowledged with regret by the Municipal Commissioners who accompanied me at my inspection; but, as was pointed out by the President, to whom I wrote on the subject, the municipality is simply powerless to improve the existing state of things to any very large extent. He quite allowed that Broach is dirty and badly drained, and requires latrines, improved water-supply, and a system of drainage; but the city is, with one exception, the most heavily taxed municipal town in the Northern Division, and its income, being only about Rs. 77,000 a year, is very small, and as it cannot borrow money, it is impossible to provide the funds for the necessary cost of the actual works required to put the town into a sanitary state.

At Ahmedabad, in company with Ráo Bahádur Runchodlál Chotalál, I went over the line of the new municipal tramway, which has been constructed for the conveyance of the dry sweepings and nightsoil out of the city to a site which appeared to me appropriate and safe.

My report on Quetta Cantonment was forwarded by the Government of Bombay to the Government of India, and my proposals regarding it are still under consideration.

Among the important events of the year I must notice that the Government of India in the Home Department (Sanitary) in Resolution No. 9-227-31, dated 31st July 1885, and republished in Bombay Government Resolution, No. 3,071, dated 14th August 1885, directed that, for the future, bills of health should be signed by the Health Officer of the Port, and shall be to the following effect:—

Bill of Health.

This is to certify that the ship is, at the time of leaving this port, in a satisfactory sanitary condition, and that no case of infectious disease dangerous to life exists among its officers, passengers, or crew.

It is further certified that the town and port of are at present free from epidemic cholera, plague, yellow fever, and all other dangerous epidemic diseases.

Dated the } Signed) Health Officer of the Port.

The Health Officer of the Port has submitted a long and interesting annual report in which he reviews the sanitary history of the year, so far as it is connected with his office, and from which I extract the information necessary to show Government the amount of work performed, &c.

During the year Dr. MacCartie brought to notice that he was often put to the greatest inconvenience by masters of vessels not having at the time of the inspection secured the attendance of all persons who were to sail in his vessel: *e.g.*, during the six months ending 30th June 1885, he granted bills of health to 526 vessels, but he was obliged to pay these vessels no less than 967 visits, owing to the absence of some persons who were to sail in the vessel, and he pointed out that sometimes he had visited a ship as late as 10 p.m. Government was accordingly pleased to resolve that the Health Officer of the Port should not be required to go on board any vessel between the hours of 7 p.m. and 7 a.m., and that, if the master of a vessel cannot arrange for the necessary inspection to take place before 7 p.m., he must wait until next morning. Dr. MacCartie reports that since the new bill of health was introduced on the 14th August he has received every assistance from the shipping agents and masters, without exception, in carrying out the sanitary inspection of vessels. Ships were generally found to be in a fairly sanitary condition, with the exception of pilgrim ships, and these cannot be kept clean with passengers of the pilgrim class.

During the year I have received great assistance from Colonel Ducat, R.E., Consulting Sanitary Engineer, especially in connexion with the sewerage arrangements of public buildings in Bombay. He was unable to proceed to Ahmedabad before October. Eleven years ago I brought the exceptionally insanitary condition of this city to the notice of Government, and although year by year the very high death-rate has

attracted attention, nothing has been done with a view of removing the causes which have led to such a terrible mortality.

After his inspection at Ahmedabad was finished, Colonel Ducat proceeded to Sukkur in Sind, and gave the municipality there a most excellent scheme for providing the town with a plentiful supply of pure water and for reconstructing the drainage and sewerage. The municipality entered eagerly into his views, and if funds can be raised I have no doubt his proposals will be carried out. He was engaged at this work at the close of the year, and was not able to visit Hyderabad until the middle of January. As his reports will be submitted to Government, accompanied by the resolutions of each municipality on his proposals, I merely refer to them here for the purpose of bringing strongly to notice what I think is very apparent, viz., the want of knowledge regarding the details of sanitary engineering among municipal and other engineers up-country. It would appear to be highly desirable, therefore, that some attempt should be made to establish at some of our technical schools or colleges a chair of Sanitary Engineering where practical instruction in the details might be given. A sewerage scheme, if properly carried out, is one of the greatest boons that can be given to a community, but if due attention is not paid to the details it will prove a failure. The success of a sewerage scheme depends on the pipes being laid on a firm foundation and in perfectly straight lines, and the greatest care has to be taken to see that there is no leakage from the joints.

During the year the subject of village sanitation and conservancy was before Government, who called for reports from the Commissioners of Divisions and of Sind, and from all collectors on the subject. I also had the honour to submit to Government a memorandum which I drew up for the information and guidance of village patels throughout the Presidency for the purpose of showing them what the several insanitary conditions which obtain in villages are, and how they should be remedied, and also to instruct them in what cases they can, when authorised, put in force the powers conferred on them by Bombay Act VIII. of 1867.

Although it was not published during the year under report, I cannot refrain from mentioning that Government has during the current year been pleased to issue a resolution setting forth the principles on which a draft bill is to be prepared to give effect to the measures proposed by Government for carrying out in a more efficient manner the sanitation and conservancy in villages in the Presidency. If these principles are embodied in a legal enactment, in my opinion no more important measure, or one better calculated to exert a beneficial effect on the people of the country, will ever have been passed; and it is indeed gratifying after such long and weary years of waiting to be able to record that at last "Government have determined "to grapple with such evils as they believe to be removable or avoidable under the "existing conditions of Indian society."

Of course any interference with established custom among so conservative a race as the peasantry of this country must be expected at first to be met by passive obstruction; but I am certain, if endeavours are persistently made to teach the people and to show them the injury which is caused to themselves and their families by the neglect of sanitation, that, as time goes on, they themselves will ask that even more stringent laws for the preservation of health may be passed.

In my report for 1876 I said: "There is nothing in my opinion which would tend "to create among the people a desire to raise themselves out of their filth or to help "themselves in sanitary matters more than the establishment in every village "throughout the Presidency of a school where elementary education could be "provided." The experience I have gained during the 10 years which have elapsed since the above extract was written has still further impressed me with the necessity for the spread of education among the peasantry. The village schoolmaster would be most useful in teaching, not only the young, but also the older members of the community, the aims and objects of sanitation. He could, as no one else could, explain to the villagers assembled in conclave the risks they and their families run from the existing state of things, and could, at all events, read and explain simple tracts pointing out what the wrong conditions are and what measures should be taken to remove them.

I also in the same report urged the extension of female education for the like object. Custom rules the mode of life among the village community, but if by any possibility the women can be taught true principles of sanitation I am confident that much that is objectionable in the native custom of rearing children and in domestic arrangements would be speedily swept away, for I am convinced that female influence plays a far more important part in the affairs of the men in India than is generally supposed.

For this reason the movement in affording medical aid to women set on foot by Lady Dufferin, and inaugurated in this Presidency under the auspices of Lady Reay, seems to me, as a sanitary officer, to be of the highest value, and I regard it as all the more valuable because it is independent of Government.

In course of time, when native ladies have studied the art of medicine, which I hope they will do in large numbers, they cannot fail to be, as it were, missioners of sanitary science, and to disseminate true sanitary doctrines in every house they enter professionally. Of course this must be a work of time, but it is a matter of great gratification that at length measures are being taken which will be the means of saving life, and ensuring health and, therefore, happiness throughout the length and breadth of India.

Among other important matters which have occurred during the year, the unhealthy condition of the city of Poona has attracted attention. In it there were no less than three separate outbreaks of cholera during the year, and the increasing unhealthiness of the city is a matter of much comment. In the opinion of the Deputy Sanitary Commissioner, with which I concur, the general rising of the level of the sub-soil water since the opening of the Khadakvásla Canal, accounts for the increased sickness which has of late years been observed, especially at the setting in of the cold season, and this is due to percolation from the main canal and from the branch canals which have so injudiciously been carried through the town.

The extension of irrigation by means of canals is no doubt an inestimable boon in certain parts of the country, as the introduction of water not only enables the inhabitants to raise additional crops, but also insures a never-failing supply of pure drinking water; but at the same time it must never be forgotten that irrigation without the provision of drainage is a well-recognised source of preventible disease. The necessity for agricultural drainage has been repeatedly brought to notice by the Army Sanitary Commission, and a notable instance of the danger entailed by the want of it will be found in the immediate vicinity of our largest military cantonment in this Presidency. The condition of the soil between the Ghorpuri Cavalry Lines and the village of Moondwa, about 2½ miles to the east of the cantonment, must afford sufficient proof, even to the most sceptical, of the danger entailed by the too profuse application of water to an undrained soil. In the month of April, the hottest month of the year, this water stands stagnant in the roadside ditches, and the water level in a well close alongside the road is seen to be flush with the soil, whilst the ground for a large extent is covered with rank rushes. I was informed that part of the area had become so rotten that sugarcane will not grow, and that in the fields where it does grow an increased amount of poudrette is necessary. Can any condition be more deplorable in the immediate vicinity of a large military station and on land adjacent to that part of the cantonment where the Ghorpuri Lines are situated, the barracks in which have of late years been so notoriously unhealthy?

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1885-86.

(*Mr. H. L. Harrison.*)

A comprehensive review of the progress of all branches of work tending to the improvement of the town was given in the report for 1882–83, and also in that of 1884–85. It is not necessary therefore after the lapse of a single year to review the subject from so general a standpoint.

The following statement sets forth in summary the stages at which the bustees taken up under the provisions of Sections 280–283 stood at the close of the year :—

Improvements completed—

1 Soortee Bagan Bustee.
2 Patwar Bagan do.
3 Joorapuker and Gowalapara Bustee.
4 Bamun Bagan Bustee.
5 Kolabagan do.
6 Nather Bagan do.
7 Colvin's do.
8 Pathuriaghatt do.
9 Fool Bagan do.
10 Kalaker do.
11 Parseebagan do.
12 Kaloo Ghose's do.
13 Jorabagan do. Sec. 283-A.

Improvements commenced—

14 Soorhatta Bustee.
15 Keranee Bagan Bustee.

Projects finally approved, but work not commenced—

16 Durponarain Tagore's Bustee No. 1.
17 Durmahatta Bustee.
18 Ooriapara do.
19 Fukeer Chand Mitter's Bustee.

Projects laid before the Commissioners in Meeting for orders under Section 283-A—

20 Shaikpara Bustee.

Draft projects of the improvements approved by the Bustee Committee—

21 Lallbagan Bustee.
22 Kristobagan do.
23 Sickdarpara do.

Orders issued to draw up the draft reports—

24 Hanspuker Bustee.
25 Moydaputty do.

Inspected by medical officers and their reports received—

26 Pachagully Bustee.
27 Grabagan do.
[illegible] Moonsheetalao do.
[illegible] ovabazar do.
29 [illegible] oydatolee do.
31 Bustee north of Manick Bose's Ghat Street.
32 Do. south of do.
33 Machooa Bazar Bustee.

Improvements ordered to be postponed—

34 Ganguly's Lane Bustee.

Improvements not necessary—

35 Durponarain Tagore's Bustee No. 2.
36 Kobirajpara Bustee.

Orders passed to inspect the Bustee under Section 280—

37 Rajbullubpara or Goalapara Bustee.
38 Bustee north of Baug Bazar.

The progress made by the Bustee Committee in preparing projects has latterly tended to outrun the progress which it has been possible to make from the bustee allotment in executing these projects. This has not escaped the attention of the Commissioners, and with a view of accelerating progress, it has been resolved in the present year to borrow 2½ lacs, a large portion of which will be allotted to bustee improvement. It may be hoped, therefore, that during the current year more

progress will be made than in any preceding year, in carrying out the various projects which have been sanctioned.

Tank filling and Bathing Platforms.—Fifteen tanks have been filled up by the Corporation during the year, in addition to 1 filled by the owner; besides the above, 2 were being filled up by the Corporation and 6 by the owners at the end of the year. The owners have also dewatered 12 tanks, which will be filled up during the current year. The sites of the two filled-up tanks in Jorapuker and Goalapara bustee in Ward No. 6 were acquired with a view to convert the space into a place of public recreation.

At the end of the year 1884–85, 28 bathing platforms were actually in working order. Great efforts were made during the year 1885–86 to increase the number to 75 before the close of the year, and for this purpose additional sites were selected so as to raise the number to 91. All of these, however, could not be opened during the year owing to the numerous objections made by the owners of the properties affected, generally in the form of claims for large severance compensation, which the collector reported in most cases to be well founded. Many sites had, therefore, to be abandoned, and new ones chosen. Often these again had to be abandoned, and a third or fourth selection made.

Eventually, the state of the platforms at the close of the year was as follows:—

Number completed, connected with piping, and actually working -	41
Completed, but not connected with piping - - - -	6
Sites obtained, and platforms under construction - - -	9
Sites in course of acquisition, declarations having been sent in - -	9
Sites selected but declarations not yet sent in (pending final approval of the Commissioners) - - - - - -	19
Abandoned and no alternative site selected - - -	7

These bathing places are very popular, and nearly all of them are double with separate screened compartments for women. A census of the number using each platform was taken on the 11th and 18th April, with the result that 40,194 males and 21,809 females were counted, in all 62,003 bathers daily.

Street Improvements.—The street improvement grant from revenue was as usual Rs. 30,000. This is for petty improvements; all larger and more important constructions are undertaken from the drainage budget. These improvements are, of course, also independent of all works carried out as bustee improvements. The expenditure was only Rs. 24,035-4-1, the saving being due to the necessity of abandoning several projects owing to the owners of premises exercising their right of having the entire premises taken up, if any portion, however small, was acquired. This demand usually so enhances the cost of the improvement as to necessitate its abandonment.

Waterworks.—The progress made in the works for the extension of the supply of filtered water to the town and suburbs is a matter of so much interest to the public that it is advisable to explain clearly how the question now stands. For completion of the supply of 20 million gallons per diem to the town and suburbs in lieu of the $8\frac{1}{4}$ million gallons obtainable hitherto, the following works are necessary:—

(*a.*) Engine power to raise 20 or (allowing for wastage and evaporation), 22 million gallons per diem at Pultah.

(*b.*) Settling tanks and filters to purify the 20 million gallons at Pultah.

(*c.*) Mains or large iron pipes to convey the 20 million gallons daily from Pultah to Calcutta after purification.

(*d.*) Pressure—(1) in Calcutta, and (2) in the suburbs to distribute the 20 million gallons to the residents after it has been received from Pultah.

The engines at Pultah are only allowed to draw water from the river during low tide, as at that time the river water is purest. During that period the present engines can draw up about 11 million gallons a day. A second set of engines was ordered out in November to pump up a similar amount. They could not be ordered before in consequence of financial uncertainty. Till their loan of 25 lacs was taken up in August, the Commissioners could not see their way to pay for these engines. The contract has now been made with Messrs. Fawcett, Preston, and Co., of Liverpool; the engines are to be shipped on the 1st December next, and it is to be hoped that they will be ready to work by the end of the current official year.

The settling tanks and filters now at Pultah will purify 10 to $10\frac{1}{2}$ million gallons of filtered water daily except during the rains when the river is charged with silt. For the reason above stated, no steps could be taken to augment these till the loan was taken up in August. Works are now in progress to add one large settling tank and

four filters to the present number which, when completed, will enable 14 million gallons per diem to be purified. These should also be ready before the end of the official year.

The 42-inch main laid in 1869 could only convey 8¼ million gallons per diem. The new 48-inch main will convey an additional 12 million gallons. This main, the excellent progress in which was reported last year, has now been completed, and was formally opened by His Honour the Lieutenant-Governor on the 20th March. It has since been subjected to such tests as the existing machinery at Tallah admits of and been shown to stand with fair success a pressure of 70 feet altitude.

It will thus be seen that hitherto the carrying power of 8¼ million gallons imposed a limit on the producing power of 10 to 10½ million gallons daily. Since the second main has been opened this has been removed. The mains can convey to Calcutta twice as much as Pultah can turn out, and, consequently, the whole 10½ million gallons were daily being conveyed to Calcutta until the rains set in, and as soon as the producing power is increased to 14 million gallons per diem there will be no difficulty whatsoever in conveying the amount to Calcutta, but experience shows that when the river is very muddy, as in the present year and in 1883, the supply may fall off for a time by nearly 25 per cent. owing to the slow action of the filters.

The whole of the water received from the 42 and 48 inch mains has to be taken up from the receiving reservoir by the Tallah engines, and distributed, or forwarded to other distributing centres. The only other distributing centre hitherto constructed is at Wellington Square, where there is a reservoir which contains 6 million gallons of water. During the day Tallah has hitherto distributed over 5 million gallons direct to the town, and during the night forwarded over 3 million gallons to replenish the reservoir at Wellington Square. Wellington Square is at present off work during the night, and during the day distributes the supply received from Tallah during the night. The engine power at Tallah is already more than sufficient to forward all the water likely to come down for several years, though the 4th or D engine is going to be fitted with a more powerful pump to enable it to be yoked with its fellow and do the same work. Contracts for this alteration, estimated to cost Rs. 75,000, will shortly be called for. The engines at Wellington Square, all of which have recently been fitted with more powerful pumps, are also equal to distributing all the water that can be sent down to them, so that as soon as the water is purified at Pultah in increased quantities everything is ready to distribute the increased supply to Calcutta, as the increased amount of 10 million gallons has already been distributed.

Distributed, but not, however, satisfactorily distributed. The original scheme contemplated the distribution of only 6 million gallons daily from two centres, and the pipe system of the town will not adequately distribute much more than this. If therefore the inhabitants of the area nearest the pumping station, or along the line of the larger distributing pipes, take off the whole amount which the pipes will convey at a pressure of (say) 60 feet, no water will be forwarded to those further off, and no increase of the supply will make any difference as long as those nearer do not close their taps. This is precisely what has happened in Calcutta. The water has annually gained in popularity until nearly the whole supply is taken by (say) three-fourths of the town, and the other third, chiefly consisting of the western section of the town and Hastings, gets scarcely any water. Certain arrangements can be and have been made by which this is very partially remedied, but no more. No proper remedy can be applied till a new pumping station has been erected for the west of the town. This has been designed and sanctioned, and the site obtained at Halliday Street, but owing to want of funds the work could not be pushed on till the loan of 1886–87 was taken up in May last. The Commissioners have now decided to push on with these works, which their funds will just suffice to complete. When completed there will be reservoirs attached to the station capable of holding 3 million gallons, into which the Tallah engines will pump a supply every night which the Halliday Street engines will distribute to the west of the town during the day. It is evident that till these engines are erected the distribution over Calcutta as a whole cannot be satisfactory, whatever amount of water may be brought down.

It has already been pointed out that the new engines for Pultah are not to be shipped before the month of December, but the Water Supply Committee has recently resolved not to let the new filters and settling tank lie idle till they are set up. A connexion has been ordered to be made as a temporary measure between the new settling tank and the existing engine-house, by which means the supply during the cold weather will be increased by about 3 million gallons daily.

The system devised for suburban distribution is to have three raised reservoirs, each 30 feet high, capable of holding between them 1½* million gallons of water. These being connected with Wellington Square will have water pumped into them every night, which they will distribute by gravitation during the day. No progress has yet been made whatsoever in constructing these reservoirs, and as long as the town and suburbs are distinct it is obviously for the Suburban Commissioners to make a beginning. It is understood that they also are restrained by financial difficulties.

From the foregoing account it appears that a satisfactory supply to the town and suburbs will be given as soon as 14 million gallons are filtered at Pultah and sent down to Tallah, of which there will be forwarded during the night to Wellington Square 4 million gallons, plus 1½ millions to be sent on to the suburban reservoirs, and to Halliday Street 2½ million gallons. The remaining 6 million gallons will be distributed during the daytime from Tallah direct. As this amount gradually becomes insufficient more filters and settling tanks will be required at Pultah, but, in all other respects, the arrangements should suffice to distribute any amount up to 20 million gallons.

The engines at the new station of Mullick's Ghat are powerful enough to distribute 5 million gallons of unfiltered water a day, but the pipes, especially towards the north-west of the town, are not large enough to forward that amount except under very inordinate pressure. The engineer has, therefore, submitted a scheme to extend and enlarge the pipes at a cost of Rs. 3,71,000. The Commissioners approved of the work, which was also sanctioned by Government, but it has had to be postponed for want of funds. It will be found practicable to complete two-thirds of the extension from the proceeds of the loan floated in May 1886.

It will be thus seen that the extension works, both for filtered and unfiltered water, and for town and suburbs, have been much impeded by the difficulty of obtaining money.

Turning now to the Engineer's report, it will be seen that the average delivery of filtered water in Calcutta during 1885–86 has been 8,106,576 gallons. This is less by 1·1 per cent. than the supply in 1884–85, but more than any year preceding that year. The engineer discusses the causes of the decline. The cost of the filtered water which fell as low as Rs. 141 per million gallons in 1882–83 rose to Rs. 159 in 1884–85, and Rs. 169 in the year under report. This, however, is entirely due to the interest now being paid on the capital already sunk in the new works. As soon as a large extra supply is obtained the cost will fall below the figure of 1882–83, which was the lowest ever attained. Rs. 140 per million gallons is equal to annas 2·24 per 1,000 gallons.

The Engineer gives some interesting statistics regarding the growth and distribution of the house supply of filtered water. The total number of ferrules in the north of the town is 10,011 against only 3,809 in the south, but the orificial area of these latter is nearly 60 per cent. that of the former, showing that they are on the average larger in size. This is, of course, due to the houses being larger. The continuous growth in the number of ferrules is as follows:—

	No.		No.
To end of 1873 - -	5,268	To end of 1883–84 - -	12,616
1877 - -	8,369	1884–85 - -	13,259
1881 - -	10,927	1885–86 - -	13,820
1882–83 (15 months)	11,687		

This is exclusive of Hastings, where there are 44 connexions, raising the total to Rs. 13,864.

The supply of unfiltered water was 1,670,024 gallons per diem as against 1,491,441 in 1884–85. As already explained, this supply can be largely augmented as soon as the capacity of the piping is increased. Since the new loan has been floated the work has been taken in hand. The cost is estimated by the Engineer at Rs. 28-13-5 per million gallons against Rs. 36-8-1 in 1884–85.

Drainage.—The drainage works in the town, with the exception of the special area at Baug Bazar and the Hastings ward, are virtually completed. The Hastings drainage, at a cost of Rs. 71,848, was sanctioned in 1884–85. The work was commenced immediately after the rains of 1885, and almost finished within the year. The scheme

* The other half million intended for the suburbs will be delivered direct from the Calcutta pipes to the suburbs adjacent to the town along its north and east boundary.

for the drainage of Baug Bazar was sanctioned at the close of the year at a cost of Rs. 2,08,123.

The following is the outturn of work done during the year, Hastings being shown separately from the rest of the town :—

	Brick Sewers, l. feet.	15-inch pipe l. feet.	12-inch pipe l. feet.	9-inch pipe l. feet.	6-inch pipe l. feet.	Total Length, l. feet.
Wards 1 to 17 - -	—	—	470	1,043	20,013	21,526
Hastings, Ward 18 - -	2,100	—	661	5,974	8,005	16,740
Total in 1885–86 - -	2,100	—	1,131	7,017	28,018	38,266
Corresponding total in 1884–85	640	88	1,200	2,242	28,627	31,797

It will be seen that in the rest of the town the drainage work was almost entirely limited to sewering with 6-inch pipes most of the remaining open ditches and then filling them up and converting them into footpaths.

The Commissioners at the end of 1884-85 consented, at the earnest recommendation of the Engineer, to separate the house drainage inspection work from the water-cock inspection, and to delegate the duties to separate staffs. The result has been that six drainage inspectors have been set apart for the work of supervising new connexions, and of inspecting old connexions under Section 231. The following statistics show the amount of work done and also the results of the inspections :—

Total premises in town 33,969.

Connected with sewers to end of 1884–85 - -		21,081
1885–86 - - -		1,401
Total - -		22,482
Inspected by staff—Connected premises - -	4,701	
Unconnected premises - -	646	
		5,347
Defects discovered in - - - -	1,070	

It appears that each inspector on an average—

Supervised during the year - -	233 new connexions,
Inspected do. - -	783 connected premises,
Ditto do. -	108 unconnected do.
Total -	1,124, or, allowing 281 working days

in the year, four premises per diem.

In the 4,701 connected premises the drains were found defective in 1,070 premises, or 22·7 per cent. Of course the defects are not all equally serious, but still the discovery of so large a proportion shows clearly the urgent need for an establishment of this kind. Orders have now been passed to give the occupiers a written notice of the result of the inspection and for a superior officer of the department to re-inspect a certain proportion of those reported to be in order, to see if the report is reliable.

The storm-water outfall works which were completed at the end of 1884–85 have worked well and successfully during the year.

Roads and Conservancy—Roads.—2·16 miles of roadway were added to the public streets during the year and 1·8 miles of sewered ditches. The total public roadway at the end of the year was therefore—

	Miles.
Roads, stone metalled -	72·52
„ brick metalled -	69·85
Sewered ditches „ -	33·34
	175·71

The sewered ditches are a somewhat onerous charge, as it is most difficult to keep them clean. In hardly any other city would such narrow paths be accepted as a public

charge, but in Calcutta they are very largely used as mehter passages, by which the mehters get access to the privies without entering the houses. This is so great a desideratum in the case of the bulk of the residents of Calcutta, as to counterbalance the difficulty of keeping them clean.

Conservancy.—The average number of carts that were daily made available for the removal of refuse from the public streets was 388 as against 336 municipal and 34 hired carts, total 370, in 1884–85. This is independent of the bustee hired carts for the removal of refuse from the interior of bustees. This result was obtained in spite of the prevalence of rinderpest which caused the death of 43 out of 154 horned cattle in the Gowkhannah during the year. The waggon loads of sweepings removed to the Salt Lakes is reported to have been 13,525, but the number reported by the railway is only 12,237.

Sanitation.—The Commissioners invite public attention to Dr. Sanders' remarks (see p. 139) on the causes of the enormous infant mortality in Calcutta, especially to the contrast between the large amount of tetanus among infants which occurs in private families, as compared with the entire absence of this disease from the Eden Hospital. It seems difficult to doubt that the confined atmosphere of the room in which newly-born children are kept has much to do with the disease.

Dr. Sanders also calls attention to the sanitary improvements required, which are the following:—

(1.) The flushing of drains in bustees by laying on unfiltered water to the summit of each drain.

(2.) Supplying bathing platforms with filtered instead of unfiltered water.

(3.) Filling up foul tanks and wells with earth excavated from the docks.

(4.) Obtaining from medical men the earliest information regarding disease and then disinfecting the houses and destroying the clothing; also placing the Conservancy Department under the health officer.

(5.) Ventilating the sewers by pipes carried above the houses instead of by ventilators at the road surface.

(6.) Improving the bustees below the maximum area of 2 bigahs as well as those above that area.

(7.) Improving the urinals in the town, so as to prevent their being such a serious nuisance.

(8.) Removing all hide godowns from the town.

(9.) Filling up wells and making filtered water-taps compulsory in cattle sheds.

(10.) Removing dye-shops from crowded places.

Of the above Nos. 4, 8, and 10 refer to matters under the control of the health officer, and the attention of the new Health Officer has been specially invited to them. The Commissioners have for sometime past been ready to place the Conservancy Department under the Health Officer, but Dr. Simpson has asked for time to look round him, and to get his present departments in hand before assuming charge of the conservancy. The question of increasing the power of the Commissioners in regard to disinfecting houses and destroying diseased clothing is under consideration in connexion with the revised Act.

Nos. 1, 5, and 7 require the co-operation of the Engineer. They are all matters which are known to be receiving his attention. The law already allows the sewers to be ventilated by pipes run up the sides of houses (section 227), and the Commissioners have recently specially requested the Engineer to give effect to this section in the Chitpore Road, where the ventilation of the sewer at the road surface has been much complained of. His attention has again been drawn to the matter.

As regards No. 2, it was originally contemplated to supply bathing platforms with filtered water, and all that prevents this being done is the delay in the provision of an increased supply due to want of funds.

As regards No. 3, the Commissioners have already prepared an agreement with the Port Commissioners to bring earth from the dock excavation into town at a cheap rate, with the intention of using it largely for tank filling as soon as the rains cease. For filling up wells they must wait for the passing of the new Act. There will, however, be still this difficulty that tanks are filled up at the cost of the owners, and at the very best it will cost five times as much to fill up a tank with earth as with refuse with a top-dressing of earth. Hence it may be feared that many of the owners will object to the measure.

As regards No. 6, there is nothing in the law to prevent any bustee being improved, but the Commissioners have found it difficult to enforce the construction of regular roads in bustees less than 2 bigahs in area. The rule requiring 3 feet of space between huts is already in force, and the Commissioners leave it to the owners to apply for filtered connexions; they have already framed rules for regulating such connexions.

As regards the 9th suggestion, well filling must wait the enactment of the new law before it can be insisted on, but many wells are now filled up with the consent of their owners. The town council will be asked to consider the question of making a filtered connexion a condition of a cowshed license.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1885-86.

(Dr. R. C. Sanders.)

The duties of Health Officer were performed by Dr. O'Brien until the 31st October 1884. On his leaving Calcutta I was appointed to the office until a permanent health officer was elected.

The meteorology of the year was characterised by few departures from the average of the past 48 years. The barometric pressure for the whole year was a little above the average; but so uniform was the pressure that the month of May shows the greatest fluctuation, 29·731 being the pressure for May and 29·656 being the average pressure for the 24 years. The rainfall for the year was 66·36 inches against 66·38, the average of the past 48 years. August was the wettest month; no less than 26·50 inches falling in that month last year, nearly 13 inches more than the average; no violent meteorological disturbance passed over Calcutta, but there were three violent cyclones in the Bay of Bengal, and the excessive rainfall for August is doubtless due to these cyclonic disturbances in the Bay. The humidity of the year was a little above the average, 77 against 75. It is the same as the humidity for the years 1872 and 1874.

The price of food was higher than in the preceding year. Common rice sold at the average price of Rs. 3–5 per maund against Rs. 3–2 in 1884. This rise of price was chiefly attributable to the heavy floods coincident with the large fall of rain in August and September, which devastated a large area of country in Lower Bengal, and partially destroyed the crops. Meat, fruits, fish, vegetables, and other articles of food in the municipal market sold at higher prices than usual in the latter part of the year.

Vital statistics.

The registration of births was even more satisfactory than formerly. Dr. O'Brien reported that, for the year 1884, the birth registration was more satisfactory, and showed better results than that of any year of which there is a record. The total number of births registered in 1884 was 8,290, or 19·1 per 1,000. The total number for 1885 was 8,358, or 19·2 per 1,000. In Calcutta there is a very large excess of males over females, nearly two males to one female, excluding the excess males and calculating upon the female population. With the English population of males added we get a birth-rate of 29·3, which, though short of the English rate by 5·1, is, I think, very near the true birth-rate in Indian cities.

Statement of Deaths from the most prevalent Diseases from 1875 *to* 1885.

Years.	Cholera.	Diarrhœa and Dysentery.	Fevers.	Small-pox.	Other Causes.	Total Deaths exclusive of Still-births.	Ratio per 1,000 of Population, Census of 1881.
1875	1,674	1,579	5,328	720	4,345	13,646	31·4
1876	1,851	1,864	4,361	71	4,377	12,524	28·9
1877	1,418	1,683	5,151	67	4,906	13,225	30·5
1878	1,338	2,010	6,086	1,495	4,970	15,899	36·6
1879	1,186	1,516	4,796	772	4,345	12,615	29·1
1880	805	1,267	3,797	114	5,201	11,184	25·8
1881	1,693	1,491	3,765	133	5,446	12,528	28·9
1882	2,240	1,454	3,618	17	5,349	12,678	29·2
1883	2,037	1,307	3,442	73	4,925	11,784	27·2
1884	2,272	1,209	3,618	478	5,117	12,694	29·2
Mean numbers	1,651	1,538	4,396	394	4,898	12,877	29·7
1885	1,603	1,655	3,831	155	5,463	12,707	29·3

The death-rate of 1885, viz., 29·3, may be regarded as satisfactory; and when the new waterworks are finished and a plentiful constant supply of pure water for drinking and bathing is distributed all over the town, all foul tanks and impure wells closed, a further diminution in the death-rate may be expected; but until this happens no great diminution in the death-rate below the mean, 29·7 per 1,000, need be looked for. The death-rate for 1885 is a little below the mean compared with the other years of the decennium. Four years show a better record, three years are almost similar in results, and three years show a worse record.

Death-rates vary much for the different sections of the town. The higher death-rates occur principally in Hastings, Jorasanko, Taltolla, Burtola, and Shampooker. The lowest in Park Street and Waterloo Street. The two latter are chiefly occupied by Europeans in the prime of life; there are comparatively few children and fewer old people; as a rule, if the inhabitants of these sections suffer from any serious illness, they leave the town. The resident population in the hot weather and rains is, I think, much below the Census population. It is not to be wondered at then that the mortality for these sections should be only 16·7 and 13·4 per 1,000; on the other hand, the mortality in the more unhealthy sections of the town depends much upon overcrowding, but more upon poverty, bad water-supply, and age.

Statement of Deaths according to Age for the Year 1885.

Ages.	Population.			Deaths.			Ratio of Deaths per 1,000 of Population per annum.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Born dead - -	—	—	—	279	231	510	—	—	—
0—1 - -	3,185	2,902	6,087	1,536	1,283	2,819	482·2	442·1	463·1
1—4 - -	10,858	10,756	21,614	666	656	1,322	61·3	60·9	61·1
5—9 - -	14,472	12,963	27,435	245	226	471	16·9	17·4	17·1
10—19 - -	40,189	20,734	60,923	461	401	862	11·4	19·3	14·1
20—39 - -	152,293	56,774	209,067	1,904	1,218	3,122	12·5	21·4	14·9
40—59 - -	57,545	30,048	87,593	1,384	753	2,137	24·0	25·0	24·3
60—upwards -	10,275	10,225	20,500	940	1,034	1,974	91·4	101·1	96·2
Total and general ratios - -	288,817	144,402	433,219	7,136	5,571	12,707	24·7	38·5	29·3

—	Number of Deaths.	Ratio per 1,000 of Population per annum.	Ratio on estimated Births.
Hindoos - -	1,886	475·9	322·0
Mahomedans -	797	551·1	355·2
Christians - -	133	219·1	179·6
Other classes -	3	42·2	40·3
Total - -	2,819	463·1	316·4

The figures in this table agree very closely with those of the previous years. There is an increase in the children's death-rate from 1 to 4 years of age, and a very considerable increase in the number of children who have died under one year. As in former years, deaths are more frequent amongst Mahomedan children, 355·2, than amongst children of other classes of the community. Hindoos come next (with 322·0 per 1,000), whilst the rate among European children (179·6) is near the English rate per 1,000.

With the single exception of 1878, there has been a greater infant mortality during the year 1885 than there has been for any year during the decennium. The chief cause of this increased mortality has been tetanus; 1,228 deaths occurred from this

disease alone. Tetanus has shown a constantly increasing death-rate for the last ten years:—

1876	- -	313	
1877	- -	992	
1878	- -	1,006	
1879	- -	844	
1880	- -	1,055	
1881	- - -	1,087	
1882	- - -	1,101	
1883	- - -	971	
1884	- - -	1,111	
1885	- - -	1,228	

It is difficult to give a satisfactory and an accurate reason for this increase. I feel confident that a large amount of this increase is due to an improvement in the registration of deaths. Deaths are now registered as tetanus which formerly were put down to fever or other diseases. Tetanus is common in this city; the returns for the past year show that 1,228 infants died within 20 days of birth, and I feel sure that more infants died from tetanus than the former returns actually show. For the year 1885 there were 568 deaths put down as "other diseases," 100 less than in 1884. The deaths from "other diseases" have declined steadily from 1878, when they were shown as 937 to 568 which are recorded for 1885. More deaths are now recorded under the head of tetanus and fever under the head of fever and other diseases.

During the first three years of the decennium the number of deaths from fevers was more than during the last three years. It is possible that 1,491 deaths, which were shown in 1878 as having occurred from fevers and other diseases, were many of them really deaths from tetanus, especially when we find that 1885, with a very heavy death-rate from tetanus, shows a mortality less by 464 in the number of deaths from fevers and other diseases than 1878. This exceptionally high death-rate of Hindu and Mahomedan children is a very painful subject to contemplate. I feel sure that the mortality is very largely due to the surroundings of the lying-in-room. There must be some cause which is evidently a local one. For it is not existent in the wards of Eden Hospital, where the children are treated on the European system.

In the following table is shown the town mortality in contrast with the suburban mortality of the last seven years. The suburban mortality for 1885, though much greater than the town mortality, shows a slight improvement upon that of 1884:—

Years.	Town.		Suburbs.	
	Actual Number of Deaths.	Ratio per 1,000 of Population.	Actual Number of Deaths.	Ratio per 1,000 of Population.
1877 - - - - -	13,704	31·6	14,025	55·7
1878 - - - - -	16,396	37·8	17,459	69·4
1879 - - - - -	13,044	30·1	13,835	55
1880 - - - - -	11,681	26·9	11,216	44·6
1881 - - - - -	13,030	30	11,143	44·3
1882 - - - - -	13,177	30·4	10,470	41·6
1883 - - - - -	12,325	28·4	10,429	41·4
1884 - - - - -	13,256	30·5	11,389	45·2
Mean numbers - - -	13,326	30·7	12,495	49·6
1885 - - - - -	12,707	29·3	11,267	44·8

The next table gives the figures of the year in monthly detail. It shows a very satisfactory decline in the number of deaths from cholera and a very marked diminution in the number of deaths from small-pox compared with 1884. There has been a considerable increase under the head of fevers and bowel complaints. The total number of deaths is less than it was in 1884.

Suburban Deaths in 1885.

Months.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Other Causes.	Total.
January	106	7	381	276	310	1,080
February	116	10	309	174	219	828
March	336	20	363	135	229	1,083
April	421	13	275	109	237	1,055
May	217	8	263	87	214	789
June	104	8	246	84	222	664
July	107	3	295	134	275	814
August	39	—	344	163	232	778
September	19	—	352	192	289	852
October	35	—	370	205	280	890
November	123	—	462	231	293	1,109
December	254	—	449	309	313	1,325
Total	1,877	69	4,109	2,099	3,113	11,267
Ratio per 1,000 of population	7·4	·27	16·3	8·3	12·3	44·8

During the years 1884 and 1885 cerebro spinal meningitis has been epidemic in Calcutta and the surrounding districts. The disease has been characterised by inflammation of the membranes of the brain and spinal chord, and has been attended with spasms, delirium, petechiæ collapse, and at times with early death. Some have had premonitory symptoms lasting from a few hours to several days of pain in head and back; feverishness, general malaise, vomiting has been a prominent symptom. At other times the disease has come on without warning, the patients being taken as suddenly as if they had been knocked down. A sudden attack of fever coma quickly supervening, and death from collapse has taken place in a few hours. The first symptoms are usually intense headache with vertigo. The patient soon becoming either irritable and restless, with frequent bursts of maniacal delirium and fits of screaming, or else he becomes moody, taciturn, delirious, and drowsy. His head is thrown back, and the muscles at the back of the neck are in a state of acute spasm: there is great pain at back of the neck extending down the spine; the attitude is peculiar: head drawn sharply backwards, spine arched forwards; muscles of hands, arms, and legs in a position of acute flexion upon any movement of the body; he screams violently, soon his mind becomes affected; he is less sensitive to pain, and he gets muttering delirium.

Prognosis.—The disease is very fatal. The chief symptoms of this disease, which are referred to the cerebro spinal axis, are great vital prostration; pain in head and spinal column, spasms, vomiting, maniacal delirium, squint stupor, coma, paralysis attended with peculiar petechial rash. The morbid anatomical characters being congestion and inflammation of the membranes of the brain and spinal chord, especially the piamater. What is the cause of this disease? Dr. B. W. Richardson attributes it to a fungus of wheat in a wheaten flower. The cases I have seen were taking rice and dhal. Is there any fungus in rice which could cause the disease? Is the disease contagious? I do not think so, for none of the attendants upon my cases were affected by the disease.

Cholera.

Cholera was less prevalent last year than it has been for the past four years; 669 fewer deaths took place from cholera in 1885 than in 1884. Cholera in the early months of the year was very prevalent, more so than in 1884, yet in the hot weather months of March, April, and May there was nothing like the mortality of 1884. In September and October there were but few cases of cholera, yet a rapid increase took place in November and December. The returns for the first quarter of 1886 show 356 deaths from cholera. This is satisfactory, because the rapid increase in the cholera mortality from 31 in September to 198 in December 1885 has not kept up during the first quarter of 1886.

As regards the monthly mortality a gradual rise took place during February, March, and April. These months were dry, and little rain fell in March and less in April. The well and tank water would get more impure from evaporation, and there would also be a considerable increase of surface impurity. This, with a gradual sinking of the subsoil water level, is nearly always coincident with an increase in the mortality from cholera. This theory is well brought out by the returns for 1885. February

had a greater mortality than January, and March, with a less rainfall than February, shows a much higher death-rate than February. April again, with the extremely small rainfall of 0·66 inches, had the largest mortality of the year. May had a nearly average rainfall of 4·48 inches, and coincident with this rainfall the mortality decreased. In June also the rainfall was close to the average for the past 48 years, and that month was the healthiest of the year.

Statement showing the prevalence of Cholera month by month for the Town and Suburbs, in Ratios per 1,000 *of totals during the year* 1885.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Town - -	49	95	151	222	92	43	82	36	19	21	66	124	1,000
Suburbs - -	56	62	179	224	116	55	57	21	10	19	66	135	1,000

During July, August, and September the mortality was fairly constant. November was very dry. In this month the number of deaths increased, and this increase was marked in December; this was the most unhealthy month of the year.

Immigrants to Calcutta suffer much from cholera. It may be that they drink the foul stagnant water of the numerous tanks which still act as poison traps to the unwary. Out of the 142 cases of cholera treated in the Mayo Hospital during 1885, 84, or more than one-half, had been less than three months in Calcutta; many of the cases had only been a few days in Calcutta.

Sanitation has much to say to the mortality from cholera, but the intensity of the disease in the districts around Calcutta and in the towns of Calcutta, Howrah, and the suburbs, shows a marked relation in the several districts. During the year 1878 cholera was as its maximum height in the suburbs and Howrah. It had very slightly fallen in Calcutta and neighbouring districts for the previous year. This fall was steady through 1879 to 1880; all the districts showing the same decline. In 1880 cholera was at its lowest level.

A great wave of cholera swept over the whole districts in and around Calcutta during the year 1881. The rise was maintained during 1882, not in one but in all; 1883 shows a slight decline, most marked in the suburbs, to be followed in 1884 by a much greater rise, 1884 having a higher cholera mortality than any year since 1870. The maximum seems to have been realised in 1884, for the year 1885 shows a very marked decline in the whole of the districts and town under review. A further decline will, in all probability, be noticed this year, judging from the returns for the first three months of the year.

Small-pox.

From small-pox 155 deaths were registered. Out of this number 23, or 14·8 per cent., were immigrants, and had been residing in the town for less than one year. It is very difficult to secure efficient vaccination amongst people of this kind. But though difficult, I think that the vaccination has been very well and very diligently carried out. Had it not been so the epidemic prevalence of 1884 would have been followed by a very severe mortality in 1885. Dr. O'Brien's note for the first quarter of 1885 :—"That it was thought, according to the habit and history of the disease in "the town, 1885 would be an epidemic year of great severity. The mortuary "statistics of the quarter ending 31st March 1885 do not tend to support these "anticipations. In fact it would appear that the epidemic of 1884 was aborted and "controlled by widespread vaccination." I agree with this opinion, and am sure that if the population of Calcutta had not been well protected by timely and efficient vaccination the mortality from small-pox for 1885 would have been as bad as it was in 1865 or in 1850. During the year 1885, 298 cases of small-pox were reported and inquired into with the following results :—140 were temporary residents, and were in Calcutta for a period of less than one year, and 158 were above one year. Of this number (298), 63 were previously vaccinated, 78 were inoculated, and 157 were unprotected.

With regard to the character of the vaccine work, I have always found the vesicles excellent. Many children are vaccinated direct from the calf, and vaccination on this system has been regularly practised at four of the vaccine stations—Municipal Office, Medical College, Ripon Street, and Beadon Street. During the year there were altogether 12,457 primary vaccinations and 1,780 re-vaccinations performed. This department has done excellent work throughout the year.

Sanitary Improvements required.—None of the drains in bustees have any appliances for flushing. All these drains should have taps connected with the unfiltered water-supply, so that the drains could be flushed periodically, and they should be flushed at least once a day when the water is not required for watering the roads.

Bathing platforms should be supplied with filtered water at an early date.

These might be largely filled up with earth excavated from the new docks.

All medical practitioners should be required to give the very earliest information of all cases of cholera and small-pox and other infectious diseases. On receipt of this notification immediate steps should be taken to disinfect the house or bustee and to thoroughly disinfect, or, if necessary, to destroy all clothing. In cholera and small-pox cases clothing should always be burnt. The Conservancy Department should be placed under the Health Officer.

The present sewer ventilators, which are flushed with the road surface, are a source of very great nuisance, not only to the passers-by but also to the inhabitants of the houses in their proximity. The stench which issues from these ventilators is sometimes overpowering. Some other means should, in my opinion, be devised to ventilate the sewers. There was, if I remember aright, some time ago a proposal to ventilate the sewers by pipes carried 6 feet above the highest point of the houses, outside the walls of which the pipes should be put up. These pipe-ventilators should be put up at frequent intervals, and should be surmounted by a cowl turning with the wind. The present road-ventilators are not only a nuisance, but are, in my opinion, dangerous. A short time ago a boy was killed from inhaling the foul gas in the sewers.

There are many small bustees in the town which will not fall within the operation of section 280, on account of the small extent of their areas, which absolutely require roads, to enable our carts to go inside for the removal of filth and refuse. It is at present impossible to carry out this work in a satisfactory manner. In these small bustees the huts are so crowded together that no sanitary improvement can be effected in regard to them. A rule compelling hut-owners to keep a clear space of two or three feet between the huts would be extremely beneficial. Here I may remark that the want of water in such bustees is very much felt, and is the cause of very great distress to the inhabitants as well as of sickness among them. If a number of taps, regulated according to the size of each bustee, be allowed, the measure will, I am sure, be followed with the utmost benefit.

The urinals of the town are a source of the utmost nuisance. The public bitterly complain about them. Every urinal in the town is bad. The reason of this is that they are badly constructed, the space inside is too confined for convenience, and the water-supply is so placed that anyone sitting down is splashed with the water. The reconstruction of all the urinals, having regard to the space inside for the proper position of the water-taps, with good porcelain receptacles, is urgently needed. Many urinals have no water-supply, and these are a hundred per cent. worse than those in which water is laid on.

Hide godowns also create much nuisance; there have been several police prosecutions on this account, but without any effect. Heaps of hides stored in ill-ventilated godowns cannot but give out a foul smell. When the hides are removed from the carts which are allowed to stand for hours on the public street into the godowns the offensive smell which issues from the hides and clouds of dust are excessively annoying and dangerous to the public health. All hide godowns should be removed from the town.

Attention has already been directed to the gowalbarrees (cowsheds) in town, and certain improvements have been inaugurated. It will be some time, however, before the model cowshed which has been sanctioned is likely to bear the expected fruit, and radical reforms in cowsheds effected. In the meantime I would suggest that all wells in bustees and in the vicinity of cowsheds be obliterated. It is with the water of these wells, which is almost invariably permeated with sewage, that milk is adulterated, and it would be beneficial for the gowallas as well as the public to have these wells filled up. It should be compulsory to have filtered water-taps in cowsheds.

I would draw the Commissioners' attention to the nuisance caused by the indigo dye-shops in the town. There are a number of these shops in which indigo is soaked. This solution is kept rotting for weeks and months before it becomes fit for use. It is now and then stirred up, and the stench then is very offensive. There are many indigo dye-shops in crowded localities, and the mischief and annoyance caused by them are very great. If these shops cannot be entirely sent out of the town they should certainly be located in open places instead of in crowded localities.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1885-86.

(Mr. J. A. Jones, Acting President.)

Drainage.

The net amount spent in Black Town drainage during the year was Rs. 1,46,307–5–2 against the budget grant of Rs. 1,57,770. The difficulties in regard to Sewer No. 1 increased during the year, as, while the soil was of an extremely treacherous nature, the sewer was being constructed between the high houses lining Popham's Broadway, where facilities for storing surplus earth and materials were extremely limited. Though there was a large quantity of water requiring constant pumping in Sewer No. 1, that quantity was much less than was found in Sewer No. 2, where sometimes two large pulsometers were at work. This was to have been expected, seeing that the sewer was being constructed through the strata which carries the water to the Seven Wells Water Works. The depth of cutting for this sewer was in some places 14 to 19 feet deep. This sewer runs through open ground, and the chief difficulty in its construction was the amount of subsoil water and the very fine sand in the excavation. The length of sewers Nos. 1 and 2 completed were respectively 3,302 and 4,758 feet.

Surface drainage made fair progress, 43,588 feet, or over eight miles of surface drains, having been laid during the year. While executing the surface drainage, advantage is taken to re-align the streets, as far as possible, removing unsightly and inconvenient projections, and in some cases, such as Munnady Street, the houses along the side of the street for a distance of 500 feet were entirely removed and the street widened.

House drainage received much attention during the year. I look upon the reconstruction of house drainage in Madras as one of the most potent factors for improvement of health; 1,550 houses had their drains reconstructed during the year, of which 1,153 were done by the parties concerned after notice, and 397 were done by the municipality in instances where the owners failed to execute the work.

The new farm at the northern end of the outfall channel was being gradually extended during the year, but the soil is very sandy, and a considerable quantity of sewage requires to be put on it before any very satisfactorily results can be obtained. Rupees 7,149 were expended in putting down drains in other portions of the City, but Black Town drainage was the chief work. I think it better to concentrate our efforts and deal effectually with one portion of the City at a time, than to make spasmodic efforts to deal with many detached portions.

Water supply.

Much time was devoted during the year to the scheme for the improvement of the water supply, and the detailed report and estimate were in the hands of the Commissioners before the end of the year, but they had not been discussed. The work of that portion of the scheme sanctioned, consisting of off-take tower, machinery, valves, and culvert, with a double line of 24″ diameter pipes through it, were completed during the year. The expenditure up to the end of the year was Rs. 36,739, making the total expenditure to date, including purchase of bungalow and land at Red Hills (Rs. 10,689) Rs. 87,050.

The Red Hills tank was under restoration until November, and from May and up to that date the whole of the supply to the City had to be pumped from the lake to raise the water high enough to allow it to flow down the delivery channel. The net cost of the pumping (after deducting value of plant) from the date we began in the previous year amounted to Rs. 34,765–5–11. The Commissioners asked Government to pay this amount, but Government were then unable to allot funds, and by an order, dated the 1st of April 1886, No. 320 M., Financial, Government have promised to reconsider the matter in the event of an improvement in their financial position this year.

During some months the supply to the City was scanty, and the quantity supplied was 951,463 cubic feet short of that supplied during 1884–5, when the tank was also out of order. The quantity drawn off by the City very largely increased immediately water was available without pumping, and the requirements at the end of the year

were much above what was found to be sufficient in previous years. This probably was the result of the continued scarcity during the preceding 18 months when little water was supplied for tanks and irrigation.

Seeing the state of our water supply, it is satisfactory to record that 361 new house services were laid at the owners' cost during the year.

Conservancy. The total expenditure on conservancy as compared with 1884–85 (15 months) was Rs. 2,52,735 against Rs. 3,28,550–8–3, or Rs. 2,53,093–3–1 for the 12 months of 1884. The increase is therefore comparatively little. While the staff was much the same, the number of absentees (drivers, sweepers, and bullocks, supplied on contract) was very large, and the conservancy suffered in consequence. There is no doubt that as years pass on, the class from which such labour is drawn will decrease in number. The contractors seem almost unable to control the men whom they employ or rather procure for Municipal service. Yet they have considerable power over them, because a system prevails which, although not a truck system, is one approaching to it; under this almost all the coolies are continually indebted to the contractors for money received in advance, and on which advances high rates of interest are charged. It will be seen that in this way the men can hardly ever free themselves (they as a class are imprudent) and it only when the amounts deducted from their pay press upon them to an unbearable extent, that they strike work. But the men as a class are scarce, and Municipal fines for absence may amount to three times the absentees' pay, so that it is the endeavour of the contractors to get the men to work even if he has to give increased wages, that he is not always successful is seen from the number of absentees which, over the year, averaged 1·5 per cent. At present, however, the contractors are paying at the rate of Rs. 1 per head higher than the Municipality pay to him, the contractor. I can only foresee a large increase in the cost of conservancy.

Sewage farms. One new farm came into operation during the year, viz., the farm at Poodoopett. There was a loss during the year over all the farms of Rs. 1,733–9–11, chiefly due to Black Town and Poodoopett farms, both of which being new, the returns were inconsiderable in proportion to the expenditure—though a profit is no doubt a desirable result, still that is not the object in view, which is a speedy disposal of the liquid sewage brought down by the drains.

Communications. Only 33 miles of roads were reformed in 1885–86 against 49 miles in 1883, and 50 in the 15 months 1884–85. The same complaint is made as in last year, as to the delay by contractors. A Committee is now, however, sitting, considering the whole question of the construction and repair of roads, and no doubt some improved methods will be proposed.

Vaccination. The amount expended on vaccination amounted to Rs. 11,988–9–3, for which amount 38,589 persons were vaccinated, 37,049 cases or 96·0 per cent. of these having been successful; this is against a percentage of 83·6 per cent. in 1884–85. The cost per person is rather high, viz., As. 5–2, but it will in a short time be feasible to reduce the staff, which on the first introduction of compulsory vaccination, was necessarily larger than will be necessary for future requirements. It is curious to note that out of 38,589, the total number of persons vaccinated, 17,097 were under one year old, although only 15,996 births were registered during the year, and of deaths under one year there were 4,986. The Health Officer accounts for this result by the fact that many women leave Madras to be confined in their villages up-country; but many persons must also come to Madras for the same purpose. There is a decrease in the number of cases vaccinated as compared with 1884–85, but 50 per cent. of the number vaccinated in that year were operated upon in the streets and houses, whereas now, vaccination free of charge, is only possible at depôts. In 1884 new byelaws were passed, and one of these extends the time within which persons are compelled to be vaccinated from three months to six months. This may also slightly account for the falling off in the numbers. The result, however, which must be regarded with most satisfaction, is the decrease in small-pox as shown in the following table. Although we may not always have so favourable a year as 1885, there is no doubt that future figures may be awaited without anxiety.

1880.	1881.	1882.	1883.	1884.	1885.
869	1,654	355	1,957	4,064	216

The Health Officer, Dr. N. Jesudasen, reports that vaccination will soon become popular, and that largely interest is being taken by some of the more educated natives who are beginning to appreciate it on account of its protective influence against small-pox.

Vital statistics.

The number of births in 1885 was 16,108 against 16,133 in 1884, and the percentages of births registered to population were 40·1 and 40·3 respectively. The registration of births is considered by the Health Officer as far from satisfactory, and I agree with him: but it is only with the spread of education that very much improved registration is to be hoped for. It was endeavoured to organise the Vaccine Department so that it might be a check on the registration of births, and it no doubt is so, as regards the details of cases registered, but it may also have the effect of preventing births being registered at all, the persons concerned knowing well that vaccination will surely follow. The ratio of births in the various divisions of the Municipality varied from 25·4 in the 6th Division, to 43·9 in the 8th Division. The 6th Division is largely populated by Europeans. Of the total number of births, 340 were still-born.

The deaths in 1885 numbered 14,925, or 35·8 per 1,000, against 20,123, or 50·4, of the previous year, and 38·8 the average of ten years. The ratio was highest in the 1st Division, viz., 45·0 per 1,000, and lowest in the 6th Division, 23·8 per 1,000. The higher mortality in the 1st Division is thought to be due to the state of several thickly populated parcherries, and the comparatively low death-rate in the latter, where Europeans chiefly reside, to the fact that Europeans do not live throughout their whole lives in India, and that the children are usually sent to England or other places at an early age.

There were only 26 deaths from small-pox, and 184 from cholera.

One most deplorable fact is the high death-rate among children under one year. There were 5,229 deaths among children under one year, or a ratio of over 323 per thousand. The causes are evidently not far to seek, for we have them given in the Health Officer's report, and most valuable evidence this is as from one of the people themselves. He says: "For the first two days after birth, they are not allowed to "suckle the breast of their mothers, but they get a dose of honey with some carmi- "natives for these days. This is given with an object of purging them. On the "third day it is allowed to take a little milk; and till the child is a year old it gets "a dose of castor oil every morning, and some carminative decoction in the evening. "Purgatives are then administered every alternate day till the child is of four or five "years of age; it is the common belief amongst Hindu mothers that the administering "of periodical purgatives to their children acts as a prophylactic against diseases. "This sort of treatment is kept up more regularly and systematically in case of male "children." The better training of midwives is evidently a much desired result. Lady Dufferin's and Lady Grant Duff's endeavours to obtain medical women for India and to promote medical education among the women of India, will evidently be fruitful of most beneficial results if only a portion of these qualified medical women's efforts be directed to undermining the customs of which the Health Officer speaks. It is only because of his knowledge that I am in a position to make these remarks. The proportion of deaths during or shortly before or after labour was 12·4 per thousand.

While the total registered number of deaths is probably near the actuals, I fear that the causes of death as registered are often very wide of the mark. The class of registering men on Rs. 20 to 30 per month without medical training (there are no death certificates as in England) are, I think, quite unfit for what I consider most important duties, although the direct results of their work cannot be seen nor can the value of their work be accurately gauged. The Health Officer, however, proposes shortly to place before me a report containing suggestions for the improvement of this most important branch of Municipal administration.

The deaths from the different causes registered are hereinunder noted :—

—	Small-pox.	Measles.	Fevers.	Bowel Complaints.	Cholera.	Other Disease.	Total.
Deaths during 1885 -	26	67	3,595	2,807	184	8,246	14,925

ABSTRACT OF REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1885-86.

(*Mr. E. C. K. Ollivant.*)

Public Works.—Water Supply.

Chief in importance of the works undertaken or in progress during the year was the revision by Mr. Clerke of the Tansa water-supply project, to which I briefly alluded in last year's report, followed by the adoption of the revised scheme and the commencement of operations. Such progress had been made in the surveys up to the beginning of the rains of 1885 that, on the 13th August, Mr. Clerke was able to send in a sufficiently complete report, and his proposals, after being subjected to the criticism of the Consulting Engineer, Mr. Forde, were submitted by me to the Corporation on the 13th October. As I then discussed the subject at some length in a printed report which has been separately published, any further detailed description here would be useless repetition. At a Special General Meeting, held on the 19th November, the Corporation resolved to proceed with the scheme as recommended for obtaining a daily supply of 17 million gallons at an estimated cost of Rs. 1,23,00,000, leaving the question of further reservoir accommodation (for storage and distribution) to be decided hereafter. At the same time an earnest appeal, which has since been renewed, was made to Government for assistance in raising the requisite loan, and for permission to extend the period for the repayment to Government of the remainder of the Vehar Debt, in order to relieve the present generation from an undue share of the annual burden, which works of such magnitude and such lasting benefit will entail, until the outlay, principal, and interest shall have been cleared off. The Bombay Government signified their approval of the scheme and recommended the request for financial assistance to the favourable consideration of the Government of India. In reply, the Government of India stated that they were unable to accede to this application, but, as I write, I have received information that, in answer to the renewed solicitation of the Corporation, that part of the request which related to the extension of the Vehar Debt period has been granted. Meanwhile the preparation of detailed plans and estimates was proceeded with, and tenders for the construction of the dam and for the supply of iron pipes were invited. With regard to the former, the Town Council, on the 13th January, sanctioned my acceptance of Messrs. Glover and Co.'s tender, amounting approximately to Rs. 29,00,000. The excavation was forthwith commenced, and the construction of a portion of the dam across the river was pushed on to ensure water being impounded in the rains of 1886 sufficient for the vigorous prosecution of the work in the next working season. On the 24th March the Town Council sanctioned my acceptance of Messrs. Macfarlane Strang and Co.'s tender for the supply of pipes and sluices, amounting approximately to 270,000*l.*

Amongst other large works for the improvement of the supply and distribution of water in the city which were practically completed within the year under report, I may specially mention the roofing over the settling tank and filter beds at the Malabar Hill Reservoir, and the arrangements for direct connexion between the Tulsi main and the filter beds—the new catch-water channels at Vehar and Tulsi—the raising of the Tulsi dams to the full height—the construction of filter beds at Vehar—and the laying of the new 24″ main from Vehar to Bombay. The utility of these Vehar and Tulsi works, which has been explained at some length in previous reports, has since been fully realised. All disputes in connexion with the final settlement of accounts relating to the construction of the Bhandarvada Reservoir have been compromised, and in view of the additional supply now to be obtained from Tansa, the city is to be congratulated upon the location of this reservoir at its present height, notwithstanding the fact that it may exercise too great a strain on the capabilities of the Vehar Lake to meet the increasing exigencies of consumption in relation to the existing means of supply. The following roads were provided for the first time with water mains:—Kala Choki Road, Fergusson Road, Chinch Bandar Road, and Victoria Bandar, Colaba; and in many parts of the city the old distribution pipes were replaced by others of more adequate dimensions. This work and the progress made in the

development of the Deacon's meter system for the prevention of waste will form the subject of remarks in a subsequent report. During the year new quarters were constructed at the Chinchpoogly Depôt for the waterworks staff, and this concentration cannot fail to be of service for the speedy execution of repairs under such emergency as is occasioned by the bursting of a water main. Quarters were also built at Tulsi for the staff employed there.

Drainage and Sewerage.

The storm-water drainage works, sanctioned by the Corporation in March 1882, after much deliberation and discussion, were practically brought to completion within the year, comprising especially the following, viz., large sewer from the Gowalia Tank to the old main drain at Arthur Road, large intercepting sewer from Pydhoni to Bellasis Road, excavation embankment and sluice gates of the storm-water reservoir at Mahalakshmi. The beneficial result of these works and of the raising of Khetwadi and Kamathipura roads in connexion therewith is incontestable, and has been amply proved in the exceptionally heavy rains of the monsoon which is now terminating. Places which formerly were knee-deep in water for many hours after a comparatively moderate fall of rain are now dry in a very short space of time, and the nuisance which has always existed on the Flats during certain months has now been much reduced by the new arrangements, which provide both for discharging the polluted water as quickly as possible and for flushing out the basin periodically with a large body of sea-water. The result achieved, which is still necessarily incomplete, is perhaps hardly as fairly estimated as it deserves to be, because—

(1) the objects to be attained, and the difficulty in attaining them, can only be known to the comparative few who have studied the question comprehensively, and out of the many who can find just cause of complaint with the nuisance, which, though less now than formerly, is at times very unmistakeable on the Flats, few discriminate as to the cause of that nuisance, and fewer still have practical experience of the far greater nuisance and inconvenience which was occasioned, until these measures were introduced, by the ponding up of water in certain populous parts of the city;

(2) the scheme is incomplete in two ways: first, because it does not, and never pretended to, deal with anything but a specified limited area (that, however, which is the most densely populated), and persons still suffering from floods, whether on the Queen's Road or at Parel, cannot be expected to appreciate a surface drainage scheme from which, so far as their own experience is concerned, no benefit is derived; and, secondly, because the scheme cannot, as has repeatedly been stated from the outset, even within its own proper area, be perfected, so far as freedom from nuisance is concerned, until all sewage is diverted from the Flats, as it should unquestionably and without any further delay be diverted, into channels adapted to its reception and capable of carrying it away to a suitable point of discharge. Whatever good may have been accomplished by this or any other municipal improvement weighs but little in the balance of popular judgment so long as an undoubted evil remains impressing itself upon the perception.

The old drains and sewers, into which storm-water finds and must continue to find free admission, lead either to the Harbour, Back Bay, or the Flats, and any filthy matter which obtains entrance into the same channels must follow the same course as the rain-water. With the object, amongst other things, of preventing the pollution thus caused, a new system of sewers has been adopted, which, terminating at Love Grove, where expensive pumping machinery has been erected, will provide for the carriage of all polluted matter, *i.e.*, sewage as distinguished from rain-water, to the exclusion of the latter, which will proceed by gravitation as heretofore to its natural outlets. Another object of the new system is to provide, more economically than could otherwise be done, efficient sewerage for large areas now being rapidly built over, which are absolutely destitute of any proper means for getting rid of liquid pollution. The principal works in progress during the year in furtherance of this system were as follows:—Completion of the new ovoid sewers in Ripon and Clerk Roads, and of 5·94 miles pipe sewer in connexion therewith along the De Lisle Road, Arthur Road, and in the Agripada district. The whole of this area, which is now being covered with buildings, has hitherto been without sewerage of any kind whatever.

About 3,000 feet of the new ovoid sewer from the Fort to the new main sewer at the Crawford Market were constructed during the year, but for the reasons given in last year's report the progress made has not been as satisfactory as could have been wished. This sewer, whilst serving the many new and important buildings along and

adjacent to the road from the Bazar-gate Garden to the Crawford Market, a locality hitherto unprovided with sewerage of any kind, was chiefly designed to intercept and carry to the new pumping station the sewage of the Fort, which until now has been discharged into the harbour. As a temporary expedient, and until the new pipe sewers of the fort are completed and in use, it will serve the old sewers during the dry months. The work of constructing these pipe sewers, the contract for which was let in March 1885, is being rapidly proceeded with, and 30 per cent. of it has already been completed.

Important improvements and additions were made in the new pumping station at a cost of Rs. 32,217, the work being carried out departmentally and within the estimate. The accommodation of the cooling tank was increased from 560 to 2,978 square yards, so that sufficient water might be stored for the working of all four engines. A weigh-bridge, fitting-shed, and store-room were erected, and a kiln was constructed in immediate proximity to the shred-lifter, which prevents solid refuse from finding its way to and blocking the pumps. By the arrangement adopted the shred-lifting chamber is covered in, and the refuse, which is often most offensive, is at once burnt without being exposed to the open air.

House Connexions.—It has been repeatedly explained that what are somewhat misleadingly termed "house connexions" form an inseparable feature of the new system, that is, there must be some channel, means, or appliance, by whatever name it be called, which will conduct polluted water or excrementitious matter from the premises where the pollution occurs to the nearest sewer, and it is subject to the condition that whilst it is provided with proper methods of ventilation to prevent danger or nuisance, it *must not* have such openings or be so situated as to allow of the admission of any appreciable quantity of rain-water to the sewers; for these sewers are not intended or adapted to carry off the heavy rainfall of Bombay, and if they could accommodate it, the pumps at the end of the sewers could not lift it. Polluted matter, therefore, which passes off from premises otherwise than by means fulfilling this condition can only follow the same course which rain-water follows, and, consequently, until the so-called house connexions on the new system are generally introduced, so long must the rain-water which passes off to the Harbour, Back Bay, or the Flats, as the case may be, remain highly charged with polluted matter. These connexions may be made to serve for the removal of sullage, or of excrement, or of both.* If expense be no object, the present system of halalkhor service can be maintained, so long as halalkhors are found willing to serve; but none the less must there be means for the removal of sullage, which fulfil the one indispensable condition. The cogency of this requirement is affected in a twofold manner by the determination to double the present water-supply; first, because the quantity of polluted water to be carried off will be doubled, and there is great urgency on sanitary grounds for making provision for this; and, secondly, because the most valid argument hitherto used against the completion of the sewerage scheme, which, however vigorously proceeded with, must occupy five years, has been based on the want of additional water for flushing purposes. The latter consideration, however, should not, with the Tansa supply in prospect, be allowed to retard for a single day the further development of the scheme in all parts of the city and the introduction of proper house connexions for the removal of sullage. During the year under report the Corporation, after a report by a Special Committee, re-affirmed their decision that the cost of house connexions in what is known as "the First Drainage Section" should be borne by the Municipality, and presumably what is done at the public expense in one part of the town must be done in others. The work is of a difficult nature, owing to the places in which and the circumstances under which it has to be executed, and though the rates estimated have been pronounced by the consulting engineer to be ample, two invitations have failed to secure a tender within the amount. With the sanction of the Town Council, it was determined to obtain from the manufacturers the whole of the pipes and iron-work required, and contracts have accordingly been entered into, and to proceed departmentally in one selected sub-section, viz., Khetwadi, with the execution of the work, so that further experience as to rates might be gained. The house connexion work in the adjoining district of Kamathipura, which was in progress under a previous contract, is now almost completed. Delay was caused by the fact that in the con-

* *Note.*—The purport of the remarks which I made on this subject in my Annual Report for 1883–84 seems to have been curiously misunderstood by the Army Sanitary Commission, judging from the observations contained by paras. 21 and 22 of their Memorandum received under the Secretary of State's despatch of the 12th November 1885.

veyance of the pipes from England there was an abnormally large per-centage of breakage, in respect of which the liability falls on the contractors. It will be remembered that these house connexions are for the conveyance of sullage only.

It is of the utmost consequence that, in addition to proceeding with the work of house connexions in newly-sewered districts, provision should be made without delay for carrying out the pipe sewerage and house branches in that portion of the town adjoining the Queen's Road from Dhobi Talao to Girgam. There are constant and well-founded complaints as to the present state of things, and plans and estimates have already been prepared. Sanction should also be given for surveys, to be followed by action for the sewerage of Nagpada and Mazagon and for the sewerage and surface drainage of Parel. From the growth of buildings in this neighbourhood and the filling caused by this and by railway works, former levels have been completely changed. This change has not been accompanied by any corresponding provision for drainage, and the consequence is that the rain-water finds no ready means of exit, and highly charged with sewage, as it is, remains ponded up much to the nuisance and detriment of that locality.

No opportunity was lost of carrying out street improvements under the "set-back" provisions of the Municipal Act, and several road extensions of great importance were accomplished during the year.

I have now alluded to the several matters comprised within the term "Public Works," which appear to me to be of the greatest moment to the city. I will only add that advantage has been taken of the Malabar Hill Reservoir operations to make a garden on the crown of the hill, which continued up to and over the reservoir on the one side and down the face of the hill on the other, with terraces and winding paths, will be, both subjectively and objectively, one of the loveliest spots in Bombay. It commands a magnificent view and occupies such a prominent position that to those below the verdure-clad slopes will be a welcome relief from the bare red hill-side which has been such a disfigurement ever since the large excavations to furnish material for the reclamation of Back Bay were made. Also in construction of the embankments of the lake on the Flats, I have taken the opportunity to double the width of the Vellard so as to secure a riding-path and promenade planted with trees, with a fine open space at the Mahalakshmi end, which will be appreciated by the numbers who resort to this place to enjoy the sea-breeze.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1885.

(*Surgeon-Major T. S. Weir.*)

Vital statistics.

The mortality of the year commenced with a low incidence in January, and, increasing in February, attained its greatest proportions in March and April. The mortality in the two last quarters progressively decreased. While the total deaths are 692 less than in the year before, they are only 58 less than the average deaths of the five preceding years. Exclusive of still-born, 21,850 deaths were registered, giving a death-rate of 25·8 per 1,000 of population. The mortality exhibits a high female, but a comparatively low male, death-rate; the preponderance of female mortality is in accordance with the experience of previous years. While the mortality of females is as high as 33·8 to each 1,000 of population, the death-rate of males is only 24·5. It must be remembered in appraising the female mortality of this city that the proportion of female children under one year of age found in this city in 1881 was a very large one, and exceeded the proportion in London. This excess of female infants must greatly influence the female mortality, and that it does influence it is shown by the excess female mortality in childhood, for, of the total female deaths, 27 per cent. occurred in the first year of life. The proportion of females, under 1 year and from 1 to 5 years of age, in London, Calcutta, and Bombay is shown in the table following, and which has been extracted from my Report on the Census of Bombay taken in 1881 :—

	Under 1 year.	1 to 5 years.
London	2·8	9·4
Calcutta	2·1	7·5
Bombay	3·7	9·6

In the Census Report the increase of the infant population since 1872 and the balance of the sexes in 1881, as contrasted with the population found by the Census of 1872, are thus referred to :—" One of the most remarkable results," it is said, " of this " Census is the enormous increase of the infant population. Children under 1 year " of age have increased from 11,512 by the Census of 1872 to 22,636 in 1881, or an " increase of 96·62 per cent. Between 6 and 12 the population has increased 62·96 " per cent." And again in another part of the Report the increase of the female population is referred to as follows :—" Yet the increase of the male population, " prosperous and vigorous as this city has been, has not been in proportion and in " rapidity equal to the increase of the female population; for instance, the male " population has increased 16·27 per cent. and the female 26·05 since 1872; but the " most curious fact is that the proportion of females born in Bombay to total females " in 1881 is only 32·62 to 37·92 per cent. in 1872; and I may now mention that the " per-centage of males in 1881 born in Bombay is 24·54 to 26·98 in 1872. These " facts throw some light on the extraordinary increase of the infant population, and " show that the immigration—chief disturbing cause in the sex proportion and in " other conditions—is not solely an adult male immigration. They indicate the " elements now amalgamating into the population; and an annual female immigration " is of obvious social and sanitary import. It is a result which might be expected " from easy and quick communication by land and sea. In 1872 in the indigenous " population there were 860 females to each 1,000 males, and in 1881 there are 882 " females to 1,000 males; and amongst the immigrant population there were 520 " females to 1,000 males in 1872, but in 1881 there are 592 females to 1,000 males."

The Number of Deaths and Rate of Mortality at different Periods of Life under Five Years of Age.

	Deaths, 1884.	Per 1,000 of Population.	Deaths, 1885.	Per 1,000 of Population.
Under 1 year -	6,393	282·42	6,309	278·71
„ 1 to 2 years -	1,888	119·53	1,785	113·01
„ 2 to 3 „ -	762	54·08	770	54·65
„ 3 to 4 „ -	418	30·54	367	26·81
„ 4 to 5 „ -	289	18·58	273	17·55
Total -	9,750	119·26	9,504	116·25

The important question arises—What is this high infant mortality excited by? The chief causes appear to be intense concentration of population and fearful room crowding and the pollutions and impurities stifling to infant life of crowded population. When we compare the number of persons to the area of Bombay with the density of the population in London we find the general pressure of population greater in this city and the pressure fearfully more intense in the districts of most human concentration. The density of population in the most dense section of London is less than the density in any of the 12 most densely-crowded sections of Bombay, representing a population of 429,566, and which have 458·57 persons to each acre. In London the average is about 49 persons to each acre, in Bombay 52; but the extreme pressure in London is 222, whereas in Bombay it rises to 759 persons to an acre. The chances of infant life amidst so much over-crowding are weak. The density of the population is very much greater than in Calcutta, although the size of families is a little less. Bombay is, therefore, in a very much more crowded state, and its population in a very much more unfavourable position than in Calcutta. On referring to the Calcutta Report, I find that the maximum density in any one section is 208 persons to an acre, whereas in Bombay the density rises as high as 759 to an acre. The density of the population in Bombay is very much greater than in 1872, notwithstanding the extension and increase of building and dwelling space between 1872 and 1881. This city has changed greatly since 1872; the number of persons to a house has increased from 20 in 1872 to 25 in 1881. In sections, the house density and the house crowding are intense; in the 6 most crowded sections there are 24 houses to an acre; in the section of Khara Talao there are as many as 35 buildings to an acre: this indicates fearful compression.

In a former report I gave some statistics of the extent of room crowding; the extent of room crowding in this city is appalling; it can scarcely be more fearful. The danger from house crowding increases with the continuous house piling, and this proceeds with the increase of the population.

The high rate of infant mortality is deplorable, but it is possible of reduction; it has been reduced and, I believe, will still be considerably reduced by measures of drainage and house sanitation that have been carried out and are still being effected. But in the warfare with disease sanitary measures must be continuous. House and room crowding must greatly influence the mortality of children. Of the conditions coming within the scope of the Municipal Law they are probably the most active and fatal to child life. There are other conditions of potency which, though not capable of amelioration through municipal organization, are possible of reduction. Amongst a population in which the daily wage leaves so small a balance for comfort—for it is barely enough for subsistence—I am afraid a high child mortality is a result that cannot be completely avoided. From necessitous conditions arise these numerous causes of infant mortality which are so difficult of prevention, and of removal, by ordinary measures of relief.

If concentration of the population crowding of house and room is a powerful factor—the most powerful, I believe, in influencing the mortality, especially the fatality of weakly child life,—measures for diminishing the concentration and relieving the pressure of the population, and for lessening the effects and removing the impurities—most numerous—of concentration will be the most effective towards a reduction of mortality.

It is sufficient for me now to state that sanitary aims and measures, such as are possible by the utmost straining of the present law, have been steadily followed and

adopted for many years; measures to remove the increasing impurities of an increasing population, for greater cleanliness, have been progressive and enlarging. The progressive execution of drainage works, the initiation of a scheme for a greater supply of water, the improvement and enlargement of the departmental organization for the removal of refuse are all measures directed towards the diminution of the forces actively and continuously detrimental to the public health. The rapid expansion of the city has been apparent, more especially to municipal officers, for many years past. In the Report for 1882 I pointed out that the city was changing to a degree which those who lived in its midst scarcely observed. The measures that have been successively adopted during some years for the improvement of the public health have not yet been fully understood; their value will only be appreciated after years hence.

The mortality arranged in groups of important death causes is exhibited in the table following. Contrasted with the preceding year, there is a reduction in the mortality from the following chief death causes:—fevers 182, small-pox 57, phthisis 186, diarrhœa 144, and dysentery 27; and an increase from cholera 22, affections of the respiratory system 43, and all other causes, except still-born, 50. Of the affections classed under the head of diseases of the respiratory system an increase of 293 is referred to bronchitis, while a decrease of 314 in the deaths from pneumonia is registered.

Contrasted with the mean of the 5 years preceding, there is an increase from fevers 221, chiefly under the head of simple continued and amounting to 348, cholera 124, diseases of the respiratory system 525, and phthisis 124 (amongst diseases of the respiratory system is included an increase of 622 deaths in the mortality from bronchitis and a decrease of 173 from pneumonia); and a decrease from small-pox 326, measles 233, diseases of the nervous system 178, diarrhœa 145, and dysentery 96.

The decrease in the mortality from diarrhœa and dysentery is remarkable for having occurred in the same year in which an increase in the mortality from cholera was observed. It is possible that the mortality from these diseases has been influenced by the system of channels constructed to remove sewage and to carry away the rain-waters and drainage, but which for a considerable period acted as subsoil drains and channels. The new rain-water channels with the disused—empty of sewage—underground sewers of past systems and expedients must prove valuable soil-purifiers. An enhanced mortality from cholera coincident with a reduced mortality from diarrhœa and dysentery is an occurrence remarkable enough to be noted in the review of our statistics, for it has generally been observed that in a period in which cholera is prevalent there is an increased mortality from affections of the digestive system, more especially diarrhœa.

It must be noted that, in addition to the fall of water which has been noticed in wells in the city, a very remarkable decrease has occurred in the level of the water in tanks on the Flats, notably in the case of some mill tanks. In Kamathipura a fall has in this year been observed in the mortality from diarrhœa and dysentery.

Return showing the Number of Deaths from different Causes in 1885.

Causes of Deaths.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Small-pox	55	·06	Annual increment of population is calculated.
Measles	423	·51	
Fever	6,648	7·87	
Cholera	598	·71	
Phthisis	2,905	3·44	
Diseases of Nervous System	2,242	2·65	
„ Respiratory „	3,787	4·49	
Diarrhœa	937	1·11	
Dysentery	608	·72	
Accidents	330	·39	
All other causes except Still-born	3,317	3·93	
Total	21,850	25·88	

As regards the mortality by districts, Nagpada and Kamathipura, which occupied the highest places on the mortality list in 1884, now take lower places in 1885. The four sections of highest mortality (Chukla 41·02, 2nd Nagpada 40·13, Kamathipura

38·65, 1st Nagpada 37·02) are sections weighted with intense human concentration, and be it remembered that the density of population in those four districts is greater than the density of population in the most crowded districts of London. The influences hostile to vitality—the impurities arising out of this concentration—can only be resisted and overcome by breathing spaces around and within each building; and by channels to rapidly and safely carry away the liquid refuse of population; and hence the necessity for those measures of house sanitation and drainage which occupied so much attention in previous years and in previous reports.* But most unfortunately for the adoption of measures for the protection of the population in the dense districts, of buildings most crowded, from poisoning as certain as if fatal vapours were administered, the Municipal Law is impotent to help. I have been making demands on builders of houses during many years and very generally securing compliance with those demands, which were not clearly authorised by the present law, as we have had to admit on a careful examination of them when their legality has been questioned; for there is in this city a public feeling which recognises and supports tacitly sanitary measures and demands for the protection of the public health, and which does not approve of the erection of unwholesome buildings: but, with the increasing value of land and competition for rent the measures of house sanitation adopted on suggestion a few years ago, are now contested, unless that their validity is unquestionable; and during the last two years it must be confessed, judging from the records, that measures and demands for the improvement and ventilation of buildings have been more contested than ever, and their enforcement has been surrounded with greater difficulties. The impotence of the law bearing on buildings is now so well understood that efforts to enforce demands which cannot be legally enforced only diminish such influence as may, in a friendly way, be brought to bear. There are, I am glad to be able to write, many landlords who are most ready to adopt sanitary suggestions in building, even at a sacrifice of building space, but when they now see others building over open space around or within their buildings and making all space productive in rent, which they would not have done, they come to be less ready than ever to leave ample breathing space, as the concession of such space is loss of rent to their buildings. From the table showing the mortality by districts the portions of the city most needing improvement can easily be selected; the defects in those portions of the city have so often been described I need not refer further to them now than merely stating that the defects mainly consist of imperfect provision within the buildings for ventilation and imperfect facilities without for drainage, and overcrowding; in one district—Kamathipura—a system of drainage without complete house connexions has been constructed, but the time has not yet come to appraise that drainage, although it may be observed that the incidence of mortality in that district has since 1883 been a lessening one; beyond the drainage—a vital improvement—there are other improvements to be carried out, especially in house ventilation in Kamathipura.

According to class, the rate of mortality on the large Hindu population of 407,717 was 26·09 per 1,000, being very little lower than in 1884, and amongst the large and increasing class, Hindu low-castes, 35·19 against 37·47 in the year before. The incidence of the race mortality amongst the great classes of the population varied from 19 to 57 per 1,000; at one turn are Europeans and Parsees with rates of 19 and 20 to each 1,000 of their populations, and at the other Jains and low-caste Hindus exhibiting death-rates of 57 and 35. The variation of the race mortality depends not only on surrounding conditions of air and soil purity, but on conditions arising out of manner of life and sustenance.

Small-pox.

The mortality from small-pox was small. Fifty-five deaths were registered, being a little more than the mortality of 1881 and a little less than in 1882. An exceptionally long period elapsed between the serious epidemic of 1876 preceding the famine, and the next visitation in 1883. The epidemic of 1883 was preceded during the last months of 1882 by indications, which have generally been observed in the period preceding an epidemic, pointing to a resuscitation of small-pox—such indications must be carefully looked for towards the end of the next year. It is believed that the epidemic of 1882–83 was influenced by the importation in December 1882 of cases on board ship. There are in this city, as I have previously pointed out, an increasing number of susceptible elements from unprotected adults and infants. To complete the measures now lawful for the prevention of small-pox it is necessary that the vaccination of stranger-adults and re-vaccination should be made compulsory by law.

* Attention is drawn to the increasd mortality from diseases of the respiratory system.

Powers are needed to deal with the vaccination of stranger-adults, for the fatality of each epidemic is influenced by this susceptible element from immigration.

Measles. The mortality from measles was 33 less than in 1884, amounting to a reduction of ·03 amongst males and ·06 amongst females; the death-rate of males being ·46 and females ·67.

Cholera. The mortality from cholera was 22 more than in 1884. During the year 768 cases were reported, and 598 proved fatal. The proportion of deaths to attacks is shown in the table following:—

	Attacked.	Died.
Males -	489	376
Females -	279	222

Of the 768 attacked, only 93 were born in Bombay, whereas 664 were born outside; 69 per cent. of those attacked born in Bombay and 79 per cent. of those born elsewhere died. This indicates very clearly the influence of the immigrant population on the mortality of this city. The huge labouring mass which annually rolls towards this city is very susceptible of cholera influences. It must be remembered that the population which had emigrated to this city from Ratnagiri was found in 1881 to have increased enormously; in 1872 there were 56,879, but in 1881 there were as many as 126,190, that is, 121·8 per cent. more than in 1872. This influx is chiefly of labourers and toilers. A further indication of the degree in which the mortality is affected by immigration is given by the period of residence of those who suffered from cholera in our city; 257 of those attacked were under 3 months in this city, and 204 of them died, giving a mortality of a little over 79 per cent.; 75 were over 3 and under 6 months in this city, and 59 died.

The sources of water-supply immediately before attack are indicated in the statement following:—

	Attacked.	Died.
Vehar and Tulsi water - -	589	465
Well water - - - -	94	71

With the largest population there are the largest number of cases and deaths amongst the Hindu population, but the highest proportional mortality—amounting to 1·43 per 1,000—has occurred amongst Europeans: 15 deaths occurred amongst Europeans. So high a mortality from cholera amongst Europeans is exceptional; in 1884, when 576 deaths occurred from cholera amongst the whole population, only 6 deaths happened amongst Europeans; of the 15 deaths, 6 occurred in one of the most magnificent buildings in this city—the Sailors' Home—I cannot speak from personal knowledge as to the cases and the circumstances under which they arose, not having been here, but the Assistant Health Officer, Mr. Leask, who conducted an inquiry at the time, reports to me that there was not any evidence to show that the occurrence of the cases was influenced by defects in the sanitary arrangements of the building.

The highest mortality from cholera has been registered in the following districts:—Fort (South), Mahim, Fanaswadi, Tarwadi, Worlee, and Girgam. On studying the records I find that, as in previous years, the fatality from cholera has fallen heaviest on certain districts and in certain portions of districts which in former years were observed to have been most affected. Amongst other positions of cholera activity I observe that 17 cases and 11 deaths occurred in a group of dwellings surrounding wells and open space called Antoba Gosawi's Oart. In 1875 a severe fatality from cholera occurred in this oart, and the condition of the oart now is nearly the same as it was in 1875. There is no record to show the condition of the well water in 1885 at the exact time of the occurrence of the cases of cholera, but the description of the sanitary condition of the oart otherwise than in regard to the water-supply in 1875 is as applicable to it in 1885 as it was in 1875.

Fevers. From fevers there were 6,648 deaths, being 182 less than in the last year, but 221 more than the mean mortality of the 5 years preceding. Of the total deaths 5,186 were ascribed to remittent fever, 121 less than in the last year and 10 more than the average of the 5 preceding years; and 281 to ague, being 1 less than in 1884 and 131 less than the quinquennial average; 1,171 were referred to simple continued fever, 52 less than in the last year, but 348 more than the average; 10 deaths

were ascribed to enteric fever, being 8 less than the mortality in 1884. Therefore, compared with the previous year, there is a diminution in the total mortality under the four classes of fever, but an increase over the average of the 5 years preceding from remittent fever and simple continued types.

Other diseases.

The mortality from diseases of the digestive system is 149 less than in 1884 and 208 less than the average of the last 5 years. I have referred already to the reduction in the mortality from diarrhœa, which is 144 less than in the last year and 145 less than the average. The mortality from dysentery shows a less reduction than the mortality under the head of diarrhœa; 608[c] deaths were registered, which is 27 less than in the last year and 96 less than the average. To all other diseases of the digestive system 594 deaths were ascribed, 22 more than in 1884 and 33 more than the average.

From diseases of the respiratory system 3,787 deaths, 43 more than in 1884, and 525 more than the average, were registered. Of the deaths from affections of the respiratory system 2,479 were referred to bronchitis, 293 more than in 1884 and 622 more than the average; 874 were ascribed to pneumonia, 314 less than in 1884 and 173 less than the average. The increased mortality from diseases of the respiratory system indicates the necessity of greater power in dealing with unwholesome buildings. The impotence of the Municipal Law bearing on the ventilation of buildings has been pointed out in many previous reports.

Births.

The registration of births shows a little improvement when compared with 1884, but the number of births registered is less than in 1880, 1881, 1882, and 1883; 14,964 living and 1,347 still-born births were registered; of the children born living, 7,762 were males and 7,202 females; the proportion of male to female births is as 107 to 100; the birth-rate is equal to 19·35 per 1,000. In some classes the birth-rate is nearly correct; for instance, the birth-rate of Jains is 29 per 1,000, of Parsees 28, and of Hindoo low-castes 27; the birth-rate of some classes is manifestly influenced by fluctuation of population.

The number of births, although greater than in 1884, is less than in 1883; this manifestly must be due to imperfect registration. The supervision of the staff engaged in birth registration must be continuous and stringent to maintain progressive efficiency; the assistance of inhabitants in different parts of the city would also be of great value, and I hope such assistance may be secured. I have designed a form of diary of work to be kept by the staff for registration, which will facilitate supervision and tighten control.

APPENDIX.

No. 1.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1885.

1. The first abstract in this Report gives the vital statistics of the entire Indian European Army, with the exceptions stated, since the year 1870. The following are the facts:—

Years.	Strength.	Ratios per Mille of Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	577,416	1,475	60	19·34	43	62
1878	56,475	1,551	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33‡	45
1883	55,525	1,336	63	10·88	33	44
1884	54,996	1,513	67	12·56	32	44
1885§	56,967	1,533	71	14·55	23	37

* Excluding troops serving in Afghanistan.
† Including troops in Afghanistan.
‡ Calculated on the strength obtained from annual returns.
§ Excluding troops on active service in Burma.

The unsatisfactory part of this table is the increase in constantly sick and deaths, the causes of which we shall discuss further on; the satisfactory part is that which shows the invaliding in 1885 as having been the lowest of all the years, and that even the apparent increase of 2 per 1,000 in the deaths has left the total loss in 1885 of 37 per 1,000 as the smallest of the whole period.

2. We shall next abstract the corresponding statistical data for each of the Presidency Armies, beginning with the Army of Bengal:—

Years.	Strength.	Ratios per 1,000.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	363,431	1,522	61	21·00	41	62
1878	35,836	1,675	68	21·63	40	62
1879*	29,255	2,108	82	29·87	47†	77†
1880*	31,583	1,813	75	27·73	22†	50†
1881*	35,901	1,729	79	17·05	37†	54†
1882	35,164	1,579	69	13·17	35	48
1883	34,079	1,463	66	11·21	31	42
1884	33,486	1,662	70	11·68	32	44
1885	35,031	1,661	73	13·16	20	33

* Excluding troops in Afghanistan.
† Including troops in Afghanistan.

Here we have an increasing death-rate with a decreasing invaliding rate, and, in 1885, the lowest ratio of total loss for the entire series of years. During recent years the admission and constantly sick rates have been increasing.

3. The corresponding data for the Madras Army are of a more satisfactory character, and this Army is at present the healthiest branch of the Indian European Service. The results, up to the end of 1885, have been as follows:—

Years.	Strength.	Ratios per 1,000.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	110,896	1,264	60	17·69	49	67
1878	10,815	1,392	66	21·82	48	70
1879	10,444	1,428	68	16·66	45	62
1880	10,310	1,368	64	10·18	20	30
1881	10,391	1,160	60	10·97	28	39
1882	11,020	1,058	57	10·25	24	34
1883	10,498	1,013	59	10·19	33	43
1884	10,785	1,109	57	8·53	32	40
1885*	10,519	1,154	66	9·13	24	33

* Excluding troops on active service in Burma.

4. The statistics for the Bombay Army yielded the following unfavourable data:—

Years.	Strength.	Ratios per 1,000.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	103,587	1,533	57	15·27	43	58
1878	9,825	1,848	67	20·46	58	78
1879	9,883	2,173	78	15·78	60	76
1880	9,903	2,150	78	30·90	49	80
1881*	9,895	1,784	72	13·44	53†	67†
1882	11,085	1,405	61	10·37	36	46
1883	10,948	1,249	57	10·50	38	48
1884	10,725	1,455	65	19·39	31	51
1885	11,417	1,489	68	23·82	29	53

* Excluding troops in Afghanistan. † Including troops in Afghanistan.

These figures include the strength and casualties among troops at Quetta, and as the local conditions at Quetta differ materially from those at stations within Bombay Presidency, we shall exclude the Quetta strength and deaths in estimating the death-rate due to the Bombay stations. The Bombay strength is given at 11,417, and the deaths at 272. The Quetta strength was 1,672, and the deaths 139. Deducting these figures from the Bombay strength and deaths we should have 9,745 for the strength and 133 deaths, or a death-rate of 13·7 per 1,000 instead of 23·82. In the same way, if we deduct the Quetta strength and deaths from the total strength and deaths for the European Indian Army we shall have a death-rate of 12·5 per 1,000. So that the excessive death-rate in Southern Afghanistan has added about 2 per 1,000 to the general rate of the Indian European Army.

5. The actual death-rate at Quetta (Southern Afghanistan) attained the great ratio of 83·13 per 1,000 in 1885. The admission-rate was 2,187 per 1,000, the daily sick 94 per 1,000. Invaliding yielded 28·59, and this ratio added to the death-rate raised the total loss of the year to 112 per 1,000. We have elsewhere discussed the causes of this result so far as could be done from the few data contained in the reports, with the conclusion that the station, from a variety of causes connected with locality and climate, is an essentially unhealthy one, although there may be years when the sick and death-rates are under the average.

6. We have dealt with the local death-rates in the Madras and Bombay commands on other papers, and we shall here give the death-rates in different groups of Bengal stations for 1885:—

Groups.	Death-rates per 1,000.
Bengal proper	13·09
Gangetic Provinces and Oudh	15·23
Meerut and Rohilcund	18·00
Agra and Central India	10·93
Punjab	12·67
Hill stations	9·50
Bengal Presidency	13·16

As will be seen, stations on the great rivers yielded the highest death-rates of the year.

7. *Causes of death.*—We have next to inquire into the causes of these losses as classed in the following abstract for the whole Indian Army:—

Diseases.	Admissions.	Deaths, 1885.	Deaths per 1,000.
Cholera	199	122	2·14
Enteric fever	640	194	3·41
Intermittent fever	20,862	2	·04
Remittent fever	536	31	·68
Continued fever	2,171	8	
Apoplexy and sunstroke	159	49	·86
Delirium tremens and alcoholism	477	15	·28
Dysentery	1,751	49	·86
Diarrhœa	2,961	3	·05
Hepatitis	1,300	50	·88
Respiratory diseases	3,696	50	·88
Heart diseases	—	29	·51
Phthisis, pulmonary	362	50	·88
Scurvy	139	1	·02
Rheumatism, &c.	2,576	—	—
Venereal diseases	19,523	—	—

Besides these numbers there were 5 deaths from debility, 14 from wounds and accidents, 37 deaths from violence, out of hospital, 34 suicides, and 85 deaths from all other causes. It is scarcely too much to say that most of the death and inefficiency causes in this table belong to the mitigable or preventible class. To these were due 29,120 admissions out of 87,316, and 409 deaths out of a total mortality of 829. Deducting deaths from violence, to these epidemic and endemic diseases were due above 55 per cent. of the year's death-rate from disease.

8. *Cholera.*—There were in all 122 deaths from cholera, equal to a death-rate of 2·14 per 1,000, but this fact taken by itself would give a false impression of the incidence of cholera in 1885. Of these deaths, 41 took place among Bengal troops, 35,031 in number, giving a death-rate of 1·17 per 1,000. Two deaths took place in the Madras Army, equal to ·19 per 1,000; and in the Bombay Army, which includes the Afghanistan outbreak, there were 79 deaths, equal to a death-rate of 6·92 per 1,000. Of the 41 Bengal deaths two took place among troops on the march, and other two among invalids and recruits, leaving 37 deaths for the 56 stations, of which 15 only yielded deaths; and of these, Fort William reported 4 deaths, Gwalior Fortress 5, and Rawul Pindi 4. Of 17 Bombay stations, 5 yielded 7 deaths, or 0·71 per 1,000. But the Quetta force yielded 69 deaths for the station and two deaths on the march, a death-rate of 42·46 per 1,000 of the force. The simple facts show that the Quetta problem is different from that of Bombay. Of the two Madras deaths, one took place at Secunderabad and the other in Burma.

9. It is satisfactory to know that the death-rates from cholera among European troops have been undergoing very notable reductions as sanitary work has advanced at the stations. The facts for each Presidency Army has been as follows:—

Year.	Death-rates per 1,000.		
	Bengal.	Madras.	Bombay.
1860–69	9·24	—	—
1870–79	4·18	1·68	1·53
1880	4·84	0·10	—
1881	3·23	1·73	0·30
1882	1·28	0·82	0·63
1883	0·94	0·95	0·82
1884	1·34	0·93	1·4*
1885	1·17	0·19	0·71*

* Excluding Quetta.

10. As regards local causes of cholera the Sanitary Commission states that "among European "troops no sanitary defects were detected in 1885." At Allahabad, however, some defective surface drainage was noted. "At Gwalior the tanks were said to be foul, the conservancy system faulty, "and the surroundings insanitary." But renewed experience of the beneficial effect of removal of troops would appear to afford independent evidence of unhealthy locality apart from mere outward appearances. The Allahabad outbreak, which numbered in all 20 cases, was arrested at once by removing the troops. "At Lucknow, where eight cases had occurred, the community was broken up "into eight parties, each of which made one move, and no further cases occurred. At Aurangabad an "affected regiment moved into camp, after which only one case occurred." At Muttra an affected regiment was broken up into five parts and moved into camp. Two of them had no more cases, other two had each a case, and the other had two cases, and was again moved, after which the disease ceased. We have in another Memorandum discussed the Quetta cases.

11. Some further experience is given in the present Report on the subject of cholera attacks among attendants on cholera cases. But it must not be forgotten that where there are cholera cases the disease is already in the locality, and all are exposed to its influences, especially in jails. Among European troops there were 359 cases attended on by 315 persons, of whom 6 were attacked. At Native stations 354 persons attended 92 cholera cases and yielded one attack and 444 cases in jails, which had 412 attendants, had 14 attendants attacked. The influence of locality on the number attacked was thus shown, in the jail cases particularly. But the information as a whole is incomplete, for we ought to know the nature of the attacks as well as their number and the proportion of fatal cases.

12. *Enteric fever.*—This is a much more fatal disease in India than cholera, and it exercises a more important influence on the health and efficiency of the Indian Army than does that formidable epidemic. In 1885 there were 199 admissions and 122 deaths from cholera; but from enteric fever there were 643 admissions to hospital, of which 194 proved fatal, of these Quetta furnished 14 admissions and 4 deaths, leaving for the other stations 626 cases and 190 deaths. Besides the losses from enteric fever there were 2 deaths from intermittent fever, 31 from remittent fever, and 8 from continued fevers, so that the fever group occasioned 235 deaths, or a death-rate of 4·13 per 1,000 strength. The facts show that in sanitary work it is not necessary to separate these fevers, and that the causes of them, so far as preventive measures are concerned, should be discussed and remedied together.

13. The whole subject is fully dealt with by the Sanitary Commissioner in the present Report, in which he shows that enteric fever is not a new disease or a lately introduced fever, it has all along

been the fatal fever in India; that the amount of it is materially influenced by the proportion of young soldiers in the ranks and by their periods of service. To show the importance of this element in the question, it may be stated that, during the years 1876 to 1880, 36 per cent. of the troops were at and under 24 years of age, while in 1885 this percentage had increased to 48, representing a strength of 27,736 men at these ages, from among whom there were registered 143 out 194 enteric fever deaths in the whole Army. These facts are simply a repetition from another year's experience of what is now matter of common knowledge, and the remedy is, of course, to send more mature constitutions on service.

14. Enteric fever prevailed far more widely than did cholera in 1885. Out of 56 stations on the plains and hills in Bengal, 46 returned enteric fever deaths. Morar had 29 cases and 11 deaths out of 1,179 men. At Lucknow 2,289 men yielded 58 cases and 10 deaths. At Sitapur there were 24 cases and 10 deaths from among 408 men, or a death-rate of 24½ per 1,000 from this single disease. 860 men at Cawnpore yielded 13 cases, 8 of which proved fatal. Rawul Pindi, out of a strength of 2,217, had 21 cases and 10 deaths. But the most notable fact of the year regarding this fever was its fatality at the hill stations, where, on an average of six months' residence, 4,000 men had 93 cases and 23 deaths, or 5·75 per 1,000. Meean-Meerhad 20 cases and 6 deaths out of 742 men.

Of 18 Bombay stations exclusive of Quetta, 13 furnished 74 cases and 26 deaths.

Madras stations had 36 cases, of which 9 proved fatal, and 7 cases and 2 deaths were returned from Burma. Secunderabad, with a strength of 2,489, had 24 cases and 10 deaths. We have named the stations where the disease was most prevalent, but there were many others where this fever took only one, two, or three victims. Its special character was great severity in specific localities, and it is clear that, unless its prevalence in these cases can be shown to depend directly on the proportion of young soldiers who were barracked at the more severely affected stations, the predisposing causes of this fever must be sought elsewhere.

15. The Report contains little that is new on the subject of local fever causes, and it will only be necessary to notice this part of it very briefly. The Sanitary Commissioner says that, "as a rule, "medical officers who reported on the enteric fever of the various stations were unable to attribute "it to any definite cause." At Lucknow, "in no case could the disease be traced to insanitation "or faults in connexion with food or water, although it would be rash to assert positively that in a "country where the water is entirely furnished by wells the possibility of contamination should be "excluded. . . . Several cases were preceded some days by decided attacks of ague." It would appear from these facts that the fever causes in this instance were general rather than specific, and possibly some further light may be thrown on the subject by the following comparison.

At Lucknow, out of a strength of 2,289, there were 58 cases of enteric fever, of which 10 died. But besides enteric there were 644 admissions and one death from other fevers. Now let us compare with this experience among troops the facts regarding the fever history of Lucknow itself during the same year, 1885. Lucknow district, out of a population of 457,051, lost 11,998 of its people by fever, and returned a fever death-rate of 26·25 per 1,000, showing the general prevalence of fever causes in the country. Lucknow city, out of a population of 239,773, registered 6,968 fever deaths, or 29·06 per 1,000, marking a greater fever intensity than existed in the district. Of course, the fever death-rate among troops of 4·7 per 1,000 was a small matter compared with these rates for the civil population, but the station, being in the midst of a fever country, was not unlikely to have suffered from general fever causes besides those due to undrained locality, for we know from past reports that the subsoil drainage of the barracks required improvement. In the case as a whole we find ample cause for the fever, but apart from the proportion of men at the enteric fever ages, which is not stated, we do not know why the fever in a certain proportion of the cases assumed the enteric type. This, however, is of less importance, as the facts point clearly to the need of station improvements in drainage, in water-supply, and in barrack accommodation generally, as remedies.

Another fact may be quoted to illustrate the probable influence of general fever causes, namely, that Sitapur district, where the highest enteric fever death-rate among troops presented itself, lost 21,159 of its inhabitants from fever in 1885, a death-rate of 22·66 per 1,000.

Regarding the 29 cases and 11 deaths from enteric fever at Morar, the Medical Officer says:—
"As in the previous year, the disease was very evenly spread all over the barracks. As in former "years, no satisfactory explanation can be given as to the causation of the disease. No sanitary "defects of any importance were observed."

As regards alleged specific causes of enteric fever the Surgeon-General, Madras, says, "The "immunity on the part of children substantiates the statements of executive Medical Officers that "milk, as a source of the disease, may be almost entirely eliminated from the calculation." A similar remark may be made here as to an alleged relation between unwholesome milk and scarlet fever, and this is that, in 1885, out of 6,632 European children at Indian stations there were only three cases, and none fatal, of scarlet fever.

16. Considering the facts regarding enteric fever as a whole, and apart from strictly professional questions as to its diagnosis and etiology, the evidence in the present and preceding Reports appears to connect the disease with those prevailing malarial conditions which influence the nature and amount of fever at intertropical stations generally, and we know from the statistics that wherever enteric fever shows itself at the stations the whole surrounding population suffers year after year from miasmatic fevers.

The Sanitary Commissioner has told us that while the death-rate among troops from all fevers shows a disposition to remain tolerably constant, the rate from enteric fever included within the

general rate is subject to variation, and that from some cause, probably in part the increased proportion of young ages in the Army, its death-rate is increasing. The following abstract gives the facts for each Presidency Army for a series of years :—

Years.	Deaths per 1,000 Strength.								
	Bengal.			Madras.			Bombay.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870—79	2·28	1·74	4·02	1·42	0·62	2·04	1·75	1·14	2·89
1880	3·07	2·66	5·73	1·36	0·39	1·75	5·76	3·23	8·99
1881	2·62	0·81	3·43	0·58	0·19	0·77	2·83	0·91	3·74
1882	2·90	0·77	3·67	2·09	0·27	2·36	1·90	0·81	2·71
1883	2·52	0·44	2·96	2·86	0·28	3·14	1·55	0·73	2·28
1884	3·31	0·36	3·67	1·67	—	1·67	2·05	2·14	4·19
1885	4·05	0·63	4·68	2·19	0·19	2·38	2·54	1·49	4·03

As the ratios in the first and second columns in each Presidency Army show that one third of the present mortality of the Indian European Army is due to fevers, it may be useful to state very briefly what our past experience with these zymotic diseases has been.

17. In the first place, there is no satisfactory evidence that fatal fever cases are due to any single cause ; for all attempts to show that enteric fever has been due to personal transference of the disease alone have failed to include the known facts. In the same way these fevers cannot be attributed to sewer emanations, for there are no sewers. The foul air of badly managed latrines or of filth deposits have with much greater probability been assigned as fever causes, and also the insanitary conditions of population groups near stations frequented by the troops. But the disease has shown itself where no such causes could be assigned for it. Impure well water is a probable cause, but this fever has shown itself where the water was wholesome. Diseased milk, another assigned single cause, will not apply in India, where the milk drinkers nearly escape and those who do not drink milk suffer. Leaving aside these presumed what may be called specific causes, let us see whether we have any experience to guide us to the probable causes through the remedies.

18. When any endemic or epidemic disease attacks troops in barracks, a ready remedy is to camp out. So well is this remedy applied in certain countries that it is the custom to have two sets of hospitals to be used alternately. The reason of this is not far to seek, for it has been long known that continuous occupation of any crowded tenement is a disease cause. Every internal surface of long occupied buildings becomes impregnated with putrescing organic substances, and in undrained localities the ground becomes more and more polluted the longer it is occupied. By going away for a time a certain process of purification through the air oxygen takes place, and the evil is partly remedied for the time. It must not be forgotten that the action of causes of this class is continuous, so that the general stamina of men is deteriorated, and fever predisposition may be the result from continual occupation alone. Founded on these considerations rests the long established practice of arresting fever in groups of houses by removing the people, thoroughly cleansing the walls, ceilings, and floors, and then coating the walls and ceilings with quicklime wash. This duty is included among those assigned to medical officers in their regulations, wherein they are directed to see "that " the walls and ceilings of barracks, or quarters, and hospitals are limewashed twice a year, or " oftener, if necessary, and that the walls are scraped at intervals." Even during the prevalence of cholera this is one of the most effective means of arresting the disease.

It will be observed that the whole of this experience points to long continued occupation of a doubtful or unhealthy barrack or locality as a fever cause, and it follows that breaking up the occupation and camping out would reduce liability to fever.

19. That fever causes of these classes are in existence at every station of British troops at home or in India is perfectly well known ; and then we have this most important fact in the discussion, that the proportion of soldiers at the ages when enteric fever most prevails has greatly increased of late years both at home and in India, and the question at once suggests itself,—Given a fever locality in a malarial country and occupy it with soldiers at the enteric fever ages, what will be the type of the fatal fevers ? The answer is obvious, and hence a young army involves as one of its conditions of service the most rigid attention to every sanitary requirement.

The general drainage of the country surrounding a station can only be improved by agriculture, and providing outlets for the subsoil water. But the more immediate work required is not so much there as it is within the boundary of the station itself. A cantonment is simply a town without drainage in a warm climate, and until these malaria generating areas are subsoil drained, and the roof water kept out of the subsoil, and until barrack floors are raised and ventilated beneath so as to be perfectly dry and free of damp, we must expect fevers as common admission causes among troops. Whether the fever may pass away as a non-fatal form, or whether it shall present the marks of enteric or remittent fever, may depend on other personal and local causes, and it follows also from this consideration that the most rigid attention should be paid to cleanliness, ventilation, pure water drainage, and other purely local sanitary precautions. Damp barrack floors have been assigned as an enteric fever caused by the circle engineer at Bangalore quite recently. But pointed attention was also called by the Royal Commission of 1859, as frequently since then by ourselves, to the whole question of dieting, with a view to its being arranged more in conformity with the ages and peculiar

conditions of Indian service. Quite recently, indeed, the present dietetic system has been assigned by an experienced Medical Officer as a predisposing enteric fever cause.

These, taken generally, are the lessons to be learned from past experience of enteric fever, and we would suggest whether in future station reports it might not be advisable to discuss the facts of each case under the heads we have mentioned, instead of being guided by personal impressions, the result of insufficient inquiry, or of want of means of arriving at the facts. As one-third of the present mortality is due to fevers, it follows that we must seek for further reduction in the army death-rate in India mainly in the removal of their local and personal causes.

20. *Bowel diseases.*—The following abstract gives the admission and death-rates from dysentery and diarrhœa per 1,000 for the whole Indian Army during a series of years :—

Years.	Ratios per 1,000.			
	Dysentery.		Diarrhœa.	
	Admissions.	Deaths.	Admissions.	Deaths.
1870–79	40	1·48	63	0·12
1880	54	2·96	82	1·31
1881	32	1·72	56	0·32
1882	29	0·57	46	0·07
1883	27	0·38	46	0·04
1884	29	0·38	50	0·09
1885	31	0·86	52	0·05

During the last 15 years there has been a considerable reduction in the admission and death-rates from these diseases, a result which may be fairly accepted as indicative of improved sanitary condition, including better water-supply.

21. A similar reduction in the prevalence and mortality from hepatitis is shown in the following table for the whole army :—

Years.	Ratios per 1,000 from Hepatitis.	
	Admissions.	Deaths.
1870–79	50	2·19
1880	31	1·34
1881	32	1·60
1882	30	1·40
1883	29	1·13
1884	26	1·11
1885	23	0·88

In the decade 1860–69 the death-rate from hepatitis in the Bengal army was 3·31 per 1,000, and in 1885 the rate had fallen to 0·88 per 1,000, or one-fourth. Hepatitis is still fatal in the Madras army, as is shown by the death-rates for 1884 and 1885, which were 2·04 and 1·04 respectively. Intemperate habits in warm climates are among the most common causes of this disease, and one special cause, namely, exposure to cold blasts of air while in bed, has been assigned by medical officers as a cause in Madras barracks. The remedy is, of course, to provide proper shelter for the men in bed in the manner long ago advised by us in our "suggestions."

22. *Respiratory diseases* are related in India as elsewhere to exposure and climatic causes, the most remarkable illustration of this having been afforded by the Afghanistan experience in 1885. For the whole Indian Army the respiratory disease death-rate was 0·88 per 1,000, which was identical with the death-rate from phthisis pulmonalis. The conjoined rate was hence 1·76 per 1,000. The corresponding death-rates for Southern Afghanistan were, for respiratory diseases, 8·37, and for phthisis 1·20 per 1,000; together, 9·57 per 1,000. This great rate appears to have been mainly due to climatic causes, and to change of climate and elevation consequent on passage from the plains of India to an elevation of above 5,000 feet, in a region where at certain seasons temperature ranges are excessive. Probably, to the same causes was due a death-rate of 14·95 from dysentery. The lesson taught by the facts is that more attention is required in the direction of shelter and clothing of the men.

23. *Sunstroke and apoplexy* yielded a death-rate below the average in 1885. Connected with these deaths there were 15 deaths from drink. During the last nine years no fewer than 126 soldiers have died from this cause, affording a strong ground of condemnation of any canteen system which distributes alcoholic drinks to soldiers.

24. *Venereal Diseases.*—The least satisfactory part of the present Report is that which deals with these diseases. There is not only no appearance of decrease in them, but rather the contrary, as the following admission ratios for the whole of India will show:—

Years.	Admission-rates per 1,000.
1870–79	203
1880	250
1881	260
1882	265
1883	270
1884	294
1885	343

For the year 1885 the provincial admission-rates stood as follows:—

	Admissions per 1,000.
Bengal	363
Madras	350
Bombay	272

The admissions in 1885 for the whole Army included 6,972, or 122·1 per 1,000 for primary syphilis, 1,638, or 28·7 per 1,000, from secondary syphilis, 8,987, or 157·3 per 1,000, from gonorrhœa, and from all forms the admissions amounted to 20,037, or not far from one-fourth of the year's admissions from all diseases. Up to the present time no progress in the application of protective measures appears to have been made, and some of the stations still yield excessive rates, whether they are under lock hospital and police regulation or not. The whole subject is discussed in a separate paper by Dr. Barclay, in which he shows that probably some part of the increase may be due to the continued arrival in India of inexperienced young soldiers, and partly to the experimental closure of lock hospitals at certain stations, or to general laxity in the application of protective measures. One thing is evident enough, and this is that protective measures have never hitherto covered the ground at any one station. All that could have been expected from them was reduction in the number and in the severity of cases, and the controversy has in times past been directed towards arriving at the truth on this point. To show the nature of the facts we may select a few examples. A list of 10 stations is given, at which lock hospitals after having been open for 10 years were closed during 1885, with this apparent result, that the 10 years' admission ratio, which had been 210·3 per 1,000, had risen in 1885 to 351 per 1,000. But, on the other hand, a list of 20 cantonments is given, at which, notwithstanding the continued action of lock hospitals, the same 10 years' average admission-rate, which had been 270·13 per 1,000, was, for some cause, raised in 1885 to 329·06 per 1,000. One of these protected cantonments, Bareilly, had a 10 years' admission-rate of 466·1 per 1,000, which in 1885 had increased to no less than 527 per 1,000.

We have no desire to criticise the facts, but only to let them speak for themselves. But they suggest the inquiry whether, as is known to be the case at Bareilly, there are not many sources of infection beyond the reach of police supervision at all cantonments.

25. *Invaliding.*—We have already shown the proportion of invalids in each army for a series of years, and that army efficiency in this matter has undergone great improvement of late. In 1885 the loss for the whole army amounted to 23 per 1,000. Of this ratio, general debility and anæmia yielded 3½ per 1,000, the fever group 1·16, phthisis pulmonalis 2·03, hepatitis 2, and mental diseases 1·31 per 1,000. The most important invaliding cause appears to be climate and other Indian conditions acting on young unformed constitutions. Reduction of invaliding will mainly depend on improved sanitary condition of stations, on the prevalence of better habits among the men, especially in the matter of alcoholic drinks, and in sending out older recruits.

Of the total number of invalids in 1885, 22·56 per cent. had been under two years in the country, and 54·64 per cent. had had from two to five years' service. The Army of India contained 73 per cent. of men with five years' service and under, and this ratio yielded 77·20 per cent. of the total men invalided in 1885.

26. *Women and Children of Regiments.*—The health of soldiers' wives and families has improved greatly during the sanitary progress of the Army itself. The following table gives an abstract of the facts for the last 11 years:—

Years.	Death-rates per 1,000 Strength.	
	Women.	Children.
1875	25·89	69·75
1876	20·83	55·88
1877	22·50	50·33
1878	29·20	79·73
1879	25·00	75·06
1880	21·05	60·43
1881	25·93	60·17
1882	19·78	50·26
1883	21·28	46·88
1884	17·50	54·86
1885	12·87	46·29

This improvement began before the first date in this abstract, and with proper oversight of dwellings will, it is to be hoped, continue. Among women the chief death-cause was childbirth and abortion. Enteric fever caused five deaths among 3,419 women. The Presidency death-rates among women were, for Bengal 13·34, Madras 13·25, and Bombay 10·95. Among children the chief death-causes were the usual children's diseases. Four deaths were attributed to enteric fever, one to remittent, and six to remittent and continued fever. Of children's deaths 237·09 per 1,000 took place at ages under six months, and 175·15 per 1,000 between six and twelve months.

27. *Health of officers.*—The strength in India of officers, whether on leave or not, on 1st July 1885, was of British officers 2,687, and of Indian officers 2,960. From among the former there took place 38 deaths and among the latter 40 deaths. The death rate was 13·8 per 1,000 for both services.

Besides the strength in India, there were 763 officers out of India, among whom there were 13 deaths.

The chief death causes in India were, cholera 9 deaths, enteric fever 8 deaths, apoplexy 4, hydrophobia 2, accidents 5, suicides 4, and 4 officers were killed in action; dysentery and diarrhœa occasioned each 3 deaths.

28. *Native Army of India.*—The following abstract gives the general sanitary statistics for the whole Indian Native Army for nine years:—

Years.	Average Strength.	Ratios per 1,000.			
		Admissions to Hospital.	Daily Sick.	Deaths in Hospital.	Including Absent Deaths.
1877	113,966	1,030	32	10·90	13·38
1878	117,273	1,460	43	18·04	21·02
1879	121,107	1,735	58	35·15	37·79
1880	126,385	1,545	56	39·22	41·12
1881	114,612	1,305	46	19·24	22·62
1882	114,894	1,129	37	12·24	14·76
1883	114,830	923	31	11·76	14·31
1884	114,827	1,042	33	10·50	12·22
1885	115,486	978	32	13·67	16·09

The total admissions to hospital numbered 112,932, of which 48,151 were due to intermittent, 1,632 to remittent and continued fevers, 27 to enteric fever, 290 to cholera, 6,050 to dysentery, 2,875 to diarrhœa, and 6,580 to respiratory diseases. There were 3,482 admissions from venereal diseases, 4,881 from rheumatic affections, and 10,467 from abscess and ulcer. Wounds and accidents caused 12,065 admissions.

29. The death causes were as follows:—

Causes of Death.	Total Deaths.	Deaths per 1,000.
Cholera	186	1·61
Enteric fever	12	
Intermittent fever	49	2·20
Remittent and continued	193	
Apoplexy and sunstroke	21	0·19
Dysentery	87	0·75
Diarrhœa	62	0·54
Hepatitis	11	0·10
Spleen disease	9	0·08
Respiratory diseases	432	3·74
Heart diseases	26	0·23
Phthisis pulmonalis	80	0·69
Scurvy	34	0·29
All causes	1,579	13·67

The mortality in each Presidency Native Army was as follows :—

Bengal Army (Regular) - - - -	10·11
Madras „ - - - - -	9·69
Bombay „ - - - - -	24·84

The chief admission causes were fevers, respiratory diseases and rheumatism, and abscess and ulcer, marking a general prevalence of defective constitutional habit. Respiratory diseases, including phthisis, were by far the most important death causes, and between them gave rise to a death-rate 4·43 per 1,000, or double the ratio of the entire fever group.

Epidemic and endemic deaths numbered five out of every 13 deaths in 1885.

On considering the table of deaths there is no great difficulty in assigning the causes of disease. They are generally undrained locality, bad accommodation, clothing not suited to climate, and generally defective sanitary conditions. Where these are to be found of most importance can easily be learnt from the information contained in Drs. Stephen's and Wilkes' tables at the end of the Report, and from the instructive summary of "sanitary sheets of Native troops in the three Presidencies" embodied in the Sanitary Commissioner's Report. The information coincides with the statistical results, and tells us of undrained subsoils, bad hut accommodation, overcrowding, defective ventilation, thin clothing, and the like. The practical result is, that although considerable reductions in the death-rates have taken place, the ground gained requires not only to be held, but to be extended. This summary shows that a very large amount of sanitary work requires to be done at the Native stations.

30. The corresponding data for British troops in Bengal do not enter so fully into local disease causes, and the information relates more to disease history; but where both classes of troops are in the vicinity of each other at the same stations, the defects attributed to Native lines and partly to the European lines, cannot but affect the sanitary state of both lines.

31. *Sanitary works, Military.*—During the year 1885-86 a total of 573,962*l.* was spent under the following heads:—

	R.	A.	P.
Original works - - -	22,45,367	4	11
Repairs - - - -	15,49,461	5	1
Establishment - - - -	15,21,012	12	0
Tools and plant - - -	51,967	5	5
Suspense - - - -	26,320	15	6
Barrack Department - - -	4,49,000	15	7
Total - - -	57,90,488	11	6

Improved barrack accommodation had been undertaken or completed at Darjeeling, Quetta, Fyzabad, Meerut, Muttra, and Cherat. Road making had also made progress, but as regards cantonments the Report states that "owing to the orders of Government to suspend all optional "expenditure, little was done under the head of cantonment works," and certain important works had to be suspended for financial reasons. While quoting this statement we ought at the same time to recall the fact, already shown by the year's disease history, that the local disease causes which call for interference and removal are mainly those within cantonment limits.

32. *Jails.*—The Report under review contains very full information regarding the disease and death rates and general sanitary state of Indian prisons, but the details are too extensive to admit of our doing more than to give a general account of them.

The following abstract shows the principal facts for a series of years :—

Periods.	Average Strength.	Ratios per 1,000.		
		Admissions to Hospital.	Daily Sick.	Deaths, all Causes.
1872-76 - - -	99,758	1,016	?	36·24
1877-81 - - -	112,670	1,189	44·9	63·01
1881 - - - -	100,844	1,214	45	44·03
1882 - - - -	94,063	1,214	42	39·96
1883 - - - -	88,174	996	36	31·37
1884 - - -	85,496	1,025	37	29·11
1885 - - -	82,650	1,014	36	33·54

The increased mortality of 1885 was mainly due to cholera and bowel diseases. The death-rates in the jails of each Presidency in relation to these diseases were as follow:—

Presidency.	Average Strength.	Ratios per 1,000.				
		Admissions.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
Bengal - - -	49,404	1,000	36	4·07	14·68	38·40
Madras - - -	6,942	705	25	0·43	3·89	17·86
Bombay - - -	6,872	645	25	2·62	5·68	33·76

It will be observed that Madras jails in 1885, as in previous years, showed by far the best results as regards the health of prisoners, and suggest the inquiry whether their sanitary administration and arrangements might not be advantageously copied in other districts of India.

The next abstract shows the chief death causes in 1885:—

Diseases.	Deaths per 1,000.			
	Bengal.	Madras.	Bombay.	India.
Cholera - - -	4·07	0·43	2·62	3·44
Enteric fever and other fevers - -	2·49	0·43	3·64	2·18
Dysentery and diarrhœa - -	14·68	3·89	5·68	11·18
Respiratory diseases - - -	5·83	1·58	8·44	5·01
Phthisis pulmonalis - - -	2·41	1·73	2·62	2·38
Anæmia and debility - - -	2·49	1·30	1·45	2·29
Dropsy - - - -	0·85	1·30	0·29	0·79

There were in all the jails, some 240 in number in the table, 284 deaths from cholera, 14 deaths from small-pox, 8 from enteric fever, and 142 deaths from other fevers. The chief death causes were, however, diarrhœa and dysentery, from which there were 924 deaths, while respiratory diseases caused 414 and phthisis pulmonalis 197 deaths. The deaths from anæmia, debility, and dropsy amounted to 245.

In order to complete this digest it may be stated that the admissions from intermittent fever in all the jails amounted to no fewer than 30,635, or 370·7 per 1,000 strength. Dysentery and diarrhœa yielded 15,721, or 190·2 per 1,000. There were 3,738 admissions from respiratory diseases, 428 from phthisis, and 2,490 from anæmia and debility. As usually happens in these prisons, by far the most common and fatal diseases were those of the epidemic and pulmonary classes.

33. The death-rates varied greatly in different jails, an event partly due no doubt to accidental causes. But it is nevertheless a remarkable fact that Salem jail, in Madras Presidency, with an average population of 397, returned a death-rate from all causes of only 2·52 per 1,000, while six jails in Bengal Presidency returned the following death-rates:—

Burdwan - - -	108·84
Purneah - -	119·05
Julpaiguri - - -	170·94
Dinagepore - -	151·52
Rungepore - - -	116·36
Rajshahai - -	163·66

The 17 per cent. rate of Julpaiguri jail is attributed to overcrowding, defective ventilation, "drainage inside and outside the jail walls very bad." Low wet land in the vicinity. Is not this a case for removal to a better site?

The Burdwan rate included 6·80 from cholera, and is partly attributed to the low state of health of prisoners. This jail has been supplied with purer water.

The Rajshahai rate included 21·91 per 1,000 from cholera, but the other rates were without cholera. The Rajshahai rate appears to have been connected with defective drainage and subsoil soakage, overcrowding, and defective ventilation.

The great Dinagepore rate was due to malarious fevers, as was also the Rungepore rate, as well as to other removable causes.

34. When compared with the rates of past years, those for 1885, although still high in many cases, show considerable improvement, but enough has been said to show that in many jails, especially in those of Bengal, much improvement is still required, the nature of which can be readily learned from the disease and death statistics, and from the jail sanitary sheets, a summary of which is included in the present year's Report. We have to deal chiefly with the causes of miasmatic and

chest diseases, and the summary informs us that, notwithstanding numerous stated improvements in many jails, there are jails in which the following defects still exist, or some of them in individual cases,—overcrowding, defective ventilation, "bowel complaints due to sudden chills," unhealthy locality, marshy exhalations, bad water, want of drainage of site, or bad drainage. Of Delhi jail it is stated that "the water supply is extremely bad, and during the rains injurious to health." The death-rate of this jail was 8¼ per cent. in the absence of cholera. In some jails the latrines are complained of; but considering the facts as a whole, the great admission causes in jails and out of them are those due to the unwholesome malaria generating condition of the country, and one measure which might be advantageously adopted would be to improve the jail surroundings, and see that the jail area is thoroughly drained. If neither step can be taken, the removal of prisoners to more healthy localities appears to be the only resource. It seems to be unnecessary to say more, because the jail statistics and the jail sanitary sheets contain quite enough information to enable steps to be taken to remedy the evils so far as they are remediable.

35. *General population.*—This important subdivision is included under Section VI. of the Report, and gives an interesting digest of the information contained in the various Government reports on the vital statistics and disease history of each division of the country. We have dealt with the details as fully as appeared to be required for simply practical purposes in our separate Memoranda on the Provincial Sanitary Commissioner's reports, and it will only be necessary here to give a very general summary of the year's results for the whole population of India which furnishes returns.

36. The population under registration in 1885 was 197,585,350. The registered birth-rates varied between 17·48 and 45·36 per 1,000 in different Governments, showing that this department of vital statistics is still in an incomplete state.

37. The registered deaths in 1885, according to the following disease summary, were 5,177,600, but, by another table, they numbered 5,169,890, or 26·1 per 1,000, a ratio which shows that the registration of deaths is improving in efficiency, although many more deaths will have to be included under it before the real death-rate of the population is arrived at. It follows that the deaths assigned to each death cause are considerably under the truth. We must of course deal with them as they have come before us, and they are as follow :—

Diseases.	Total Deaths in 1885.
Cholera	385,928
Small-pox	80,630
Fevers	3,396,239
Bowel complaints	293,638
Injuries	83,262
All other causes	937,903
Total	5,177,600

We learn from this table that above 78 per cent. of the entire registered mortality was due to mitigable or preventible diseases, and moreover, that the sanitary problem in India is precisely what it has always been, namely, the executive removal of epidemic and endemic local disease causes.

38. We have in each separate Memorandum shown what has been the past disease history of each Government, and we may here state the facts as regards the amount of epidemic mortality for the whole Indian population for 10 years, ending with 1885 :—

Years.	Total Registered Deaths.			
	Cholera.	Small-pox.	Fevers.	Bowel Complaints.
1876	486,184	104,029	2,253,957	299,926
1877	627,577	183,734	2,504,493	392,959
1878	300,320	308,461	3,247,371	416,050
1879	270,522	194,708	3,563,025	250,137
1880	118,557	69,735	2,744,332	234,699
1881	159,213	74,153	3,184,293	259,150
1882	347,932	85,131	3,125,366	280,016
1883	244,376	232,363	2,879,659	261,623
1884	282,815	332,904	2,306,285	274,234
1885	385,928	80,630	3,396,239	293,638

The high cholera death-rates in the first two years in this table took place during the famine and scarcity period. The high death-rate from bowel diseases was partly a consequence of famine. Otherwise the registered deaths from this cause show a tendency to increase. The small-pox mortality presents the usual epidemic character, and so does that of cholera, with a marked tendency to augmentation. The enormous fever mortality is also apparently increasing, but it is not all due to fever, although the diseases classed under this head have been manifestly largely on the increase. We have called attention year after year to these facts.

The record altogether is a deplorable one, in face of the fact that all the diseases in the table belong to the well known mitigable or preventible class, towards the extirpation of which every civilised country has been labouring in past times, with the result stated in the Report of the Royal Commission on the Sanitary State of the Indian Army, that "whole regions of the earth which were "formerly devastated by fever pestilencies and dysenteries have long since been free from them, "except in the milder forms in which they now occasion part of the ordinary mortality."

39. It is not only the saving of life which is at stake, but it is also the working power of the people and the prosperity of the country which are concerned. It is one of the commonplaces of sanitary knowledge that a country which can present such a record must be a poor country, and as the action of epidemics is not only annual, but by periods of greater or less severity which together make up the record of losses, and enable us better to estimate the bearing of the facts on the general interests of the country, we may be permitted to call attention to these facts and to the following summary of them. During the 10 years the epidemic mortality has stood as follows:—

Epidemics.	Deaths.
Cholera	3,223,374
Small-pox	1,655,848
Fevers	30,205,020
Bowel complaints	2,962,432
Total epidemic deaths	38,046,674

Every one of these deaths represents numerous cases of sickness, and on a very low calculation the fever deaths would represent in fever attacks several times over the entire population of India, and all the loss of working power which fever attacks entail. We must leave the facts to speak for themselves.

40. In each Memorandum on the Reports of Government Sanitary Commissioners we have noticed generally the kind of sanitary work being done to cope with this epidemic mortality, and we have shown that, such as it is, it is almost entirely confined to municipal towns, including only a mere fraction of the population, which in reality is grouped in upwards of 400,000 villages, without real organised or effective sanitary order or administration, and it is from these villages that the enormous losses from endemic and epidemic diseases are reported.

41. The localising causes of cholera in these villages are quite well known, and are the result of continued fouling of the surface and subsoil and pollution of the wells by the accumulated filth of men and animals for indefinite periods, and of absence of general sanitary regulation. To these same defects are also mainly due the great losses of life from dysentery and diarrhœa. Fevers are mainly the result of universal absence of drainage, especially of village sites, and consequent damp or wet subsoils and damp houses, in which, as some reports state, the damp can be traced not only in the floors but up the walls to the roofing, and, no doubt, the filth conditions also influence the severity and fatality of cases.

42. Provision against the ravages of small-pox has long been made by an extensive vaccination system, but this disease too, as a previous table shows, is subject to epidemic conditions like others of its class.

We have discussed the vaccination details for each Government on separate Memoranda, and we shall here give a brief statement of the vaccination work for the whole of India during the year 1885, beginning with the establishment:—

Sanitary Commissioners	9
Deputy Sanitary Commissioners	14
Superintendents	45
Deputy Superintendents	20
Native Superintendents	76
Vaccinators, including Licensed Vaccinators	3,935
Total staff	4,099

Besides this establishment vaccinators are attached to the dispensaries in three provinces to the number of 486, and the successful operations performed in 1885 by the entire staff were as follow:—

By vaccination establishment	4,381,580
By Dispensary Vaccinators	245,176
Total	4,626,756

Besides these primary successful vaccinations there were 76,856 re-vaccinations performed by both services.

There can be no doubt that much really good vaccination work was done in the course of the year, but a reference to the decennial table of epidemics shows that small-pox is only one of them, while the ten years' statistics afford no evidence that vaccination affects the usual epidemic course of the disease, and hence this fact, in the face of the extensive vaccination work of the present and past years, appears to lead to the conclusion that in its epidemic form small-pox must be met by improving the general sanitary condition of the people, so that the really important sanitary question in regard to these Indian epidemics is, whether we have any experience to teach us how to deal with them.

43. In replying to this question we shall begin by giving a brief outline of its past history.

The Royal Commission on the Sanitary State of the Army in India (1859) dealt with these Indian epidemics mostly in reference to their probable influence on the health of the Army itself, but the principles which they laid down were equally applicable to every population group in India. From the evidence given before the Commission they reported that "the towns and bazaars in the vicinity "of lines are in the worst possible sanitary state, undrained, unpaved, badly cleansed, often teeming "with offensive and dangerous nuisances, with tanks, pools, and badly made surface gutters "containing filth and foul water; the area overcrowded with houses put up without order or "regularity, the external ventilation obstructed, and the houses overcrowded with people; no public "latrines, and every spare plot of ground covered with filth in consequence; no water-supply except "what is obtained from bad shallow wells and unwholesome and doubtful tanks. These towns and "bazaars are the earliest seats of epidemics, before their ravages extend to the European troops in "the vicinity. . . . . The arrangements for the prevention of disease are either non-existent or "most deficient. There are no proper sanitary authorities in towns, no trained officers of health "in any town or cantonment, and no means whereby the experience obtained in dealing with "sanitary questions at home can be rendered available for India."

Such having been the condition and prospects of Indian sanitary work, the Royal Commission advised "the appointment of Commissions of public health, one for each Presidency, so constituted as "to represent the various elements, civil, military, engineering, sanitary, and medical;" charged, "amongst other duties, with advising on the laying out of stations and bazaars, the sanitary improve-"ment of Native towns, prevention and mitigation of epidemic diseases, and generally to exercise a "constant oversight on the sanitary condition of the population, European and Native, to report on "the prevalence, causes, and means of preventing sickness and disease; and further that adminis-"trative measures be adopted to give effect to the advice of the Presidency Commissions." To render those proceedings more effective, the Barrack and Hospital Improvement Commission was re-organised with additions (and two representatives from the India Office), so as to include the best available sanitary experience and advice on Home and Indian sanitary problems. The Report of the Royal Commission was issued in 1863, and in the following year the reconstituted Army Sanitary Commission, at the request of the India Office, prepared its Suggestions, which include all the main practical sanitary and engineering principles for India, and on the advice of the Royal Commission all sanitary engineering proposals referred to it by the India Office have been dealt with and reported. These Suggestions, by request of the Supreme Government, were revised and re-issued in 1882.

44. We have shown in our Suggestions that Indian sanitary work, like all other similar work, includes two kinds of knowledge and experience. One of these, which is the foundation of the other, is the collection and reduction of vital statistics, the approximate estimation of disease and death causes generally, as well as in specific localities, and in reporting on these subjects to the authorities whose duty it is to undertake the necessary improvements. This executive authority must possess the knowledge and experience required for taking up the various questions raised by the sanitary reporter; for deciding on the nature of the works required; for executing the sanitary engineering surveys, properly so called; for framing estimates and schemes of works on the most economical principles; for taking the necessary steps towards their execution, and for subsequent supervision, to see that the works are efficient.

This division of duties is everywhere recognised, and, as a general rule, the reporting Health Officer is an officer of the executive authority, just as the engineering officer or inspector of nuisances is. By this arrangement each department has its own clearly defined duties, although they are each part of a well defined whole. With the exceptions to be presently mentioned, almost the sole sanitary work undertaken hitherto for the population of India has been that which corresponds to the duties of Officers of Health acting under sanitary authorities at home. This has been done by sanitary Commissioners and Civil Surgeons for nearly 20 years, in a manner which leaves little room for improvement, so that we may be said to have more accurate knowledge of the sanitary statistics and economy of the vast population of India than of that of almost any other country.

A little work has followed this reporting in a few small municipalities and villages, but if we simply inspect the epidemic death-rates in the preceding table, we can see at a glance that, while the statistical reporter has done his duty, there has been no executive action corresponding to the necessities of the case, or to fulfil the recommendations of the reporter in cases to which he has called attention.

And here arise important questions as to whether the required executive proceedings would be possible in India, and, if so, whether they would be beneficial.

45. It fortunately happens that we have illustrations in India in which intelligent reporting and more or less trained execution have been conjoined, with results as satisfactory as those attained at home, and we have also plenty of instances in which uninformed executives have done little or no good, to compare with cases where there is no executive at all, and no attempts at doing anything.

46. The Royal Commission of 1859 was aware of all the difficulties, when it proposed to place the whole Indian sanitary work in the hands of competent technical commissions of health, to guide and direct all local inquiries and improvements. This was not done, and the Officer of Health alone was appointed, with the results we have shown in the table of epidemic mortality. But while the general advice of the Royal Commission was not adopted for the whole country, it was substantially adopted for stations of European and Native troops, and for some jails. Two great municipalities, Calcutta and Bombay, obtained the powers required for carrying out sanitary work on a very extensive scale, and these were placed under trained Officers of Health and experienced sanitary engineers. But the great multitude of smaller municipal towns had neither Officers of Health, sanitary executives, nor sanitary traditions to guide them. There are a few exceptions, but up to the present their statistics have shown little sign of improvement. At the same time, Indian fairs and festivals, which used to be mere epidemic centres, were placed under sanitary regulations as regards cleanliness, water-supply, crowding, &c.

47. In the present and preceding memoranda we have shown that at all military stations, sanitary improvements have been in progress for many years, and that their advance has been marked by a continuous reduction in the disease and death rates, including those from cholera and fever, both among European and Native troops, and that there has also been a large reduction in jail mortality, especially in Madras Presidency. In the two Presidency capitals the reduction in death-rates, especially from cholera and fevers, has been most remarkable, although much in the way of improvement has yet to be accomplished. But in giving these satisfactory examples of really effective work done, we must also state that the benefits have been extended to scarcely a million and a half of the vast population of India.

Indian fairs and festivals have almost ceased to yield deaths from cholera, and we are glad to learn from the Report under review that even the Mecca pilgrimage has escaped cholera for two successive years under the action of ordinary sanitary rules.

48. With these examples before us, it is impossible to escape the conclusion that the vast civil population of India is decimated by epidemics simply because nothing effectual has been done to root out their causes, while the experience of the small municipal towns, with their uninformed administrators, furnishes us with the requisite caution that sanitary work is no chance matter, but one requiring education and experience to make it efficient. It must not be forgotten that British municipal authorities, to whom extended powers for improving the public health were granted, had been accustomed to this work in some way under old traditions, which have no place in India. The real technical work there has to be initiated as something altogether new.

49. We have shown that, notwithstanding the greatly improved health under effective sanitary work of European troops, the reduction in death-rates has not continued, but has shown rather a tendency to increase, indicating the need of pressing forwards the sanitary works we have advised, not only to continue the improvements, but to hold the ground already gained, which the statistics show is in danger of being lost. A similar remark applies to Native stations and to jails. But the most pressing question is how to save the vast civil population from the ravages of epidemics, a work which we now know by ample experience cannot be done by present methods. The Sanitary Commissioners have done their own special work admirably, but they have been quite conscious that it has borne little or no fruit, from circumstances beyond their control. Certain of them have made recommendations, involving Government execution of works, or the reorganisation of the village system to enable it to include sanitary works, or the aid of skilled engineers in forwarding improvements in small municipal towns. What are called "local fund circles," which include the village population, appear, so far as we can judge, to have done little or nothing in protecting the people from epidemics, and on the popular side the sole ray of light which we have to help us forwards is the experience of fairs and festivals, at which epidemics have been warded off by the same methods which ought to be applicable to every village site in India. The work to be done is very great, and its difficulty increases with every year's delay. It is not for us to advise the kind of sanitary administration required to meet the necessities of the case. The general principles are laid down in the Report of the Royal Commission and in our "Suggestions" of 1864 and 1882, and it is for the Government to devise the remedial arrangements required.

Before concluding the present Memorandum, we may notice briefly Dr. D. Cunningham's Paper on the results of inoculation of guinea pigs with true *comma bacillus* contained in the second volume of the "Scientific Memoirs." Cholera material was introduced by subcutaneous injections in five animals. Of these three died, and the characteristic commas were found in various organs, and were thence removed and successfully cultivated. In two cases no effect was produced, and the animals were killed and examined. Although certain pathological changes were observed, no bacilli were detected, and none were recovered by cultivation. In the fatal cases, Dr. D. Cunningham concludes that the commas exerted "a specific pathogenic influence." But he also says, "The fact "that the choleraic commas are under certain circumstances pathogenic is one thing, that they are "the efficient cause of cholera is another." The conclusion as to the facts arrived at by the Sanitary Commissioner is that "the phenomena present in these cases do not warrant the definite conclusion "that they were of a truly choleraic nature: They, however, clearly show one thing, for whether "the disease were choleraic or no, there can be absolutely no doubt that choleraic commas were "present within the intestinal canal." We can scarcely go beyond this statement on the facts as

they stand; but the subject has an important bearing on recent theories of disease causation in relation to the degree of importance which should be attached to coincidences in such inquiries. For example, to many minds certain alleged facts regarding the distribution and use of milk obtained from enteric fever dairies (as was supposed) carried the conviction that the disease was communicated in this way. It is not our intention to affirm or deny the truth of this view, or to question in the slightest degree the importance of such investigations, but we may place alongside it certain broad statistical facts obtained in India. Enteric fever is most prevalent and fatal among troops, who use little or no milk, while the women and children who are the milk drinkers nearly escape. We have already quoted the words of the Surgeon-General, Madras, that "milk as a source of the "disease may be almost entirely eliminated from the calculation." Take again the recent attempts to trace communication of scarlet fever to milk. In India milk-drinking children are almost entirely exempt from this disease. This we have also already stated. Again, if milk may be rendered infective so as to cause cholera by contaminated water (which exists all over India), how happens it that among the milk-drinking women and children, numbering 10,051, there were only 11 deaths from cholera in 1885, five of which occurred during the great epidemic at Quetta, leaving six deaths for all India and Burma, which moreover took place at five stations only out of 94 in the returns? Would it not be more in accordance with every-day experience at least in the present state of our knowledge to class such presumed causes with others in regard to the fatal action of which during cholera epidemics there is no doubt, such as fear, grief, intemperance, over-eating, improper use of aperients, unripe fruit, even drinking too much milk or too much water? But in all such cases, cholera must be in the district as an epidemic.

For actual practical purposes, the removable local predisposing causes of epidemic diseases are sufficiently known, and while, as we have advised in our Suggestions, etiological inquiries can be best carried out by specialists, this work forms no part of the duties of executive sanitary officers, which simply include the removal of ascertained local disease causes by the most efficient and economical methods.

6th September 1887.

Appendix.

The following note, explaining the sanitary procedure at home, with special reference to sanitary executives and the manner of raising funds for public health purposes, has been prepared by Sir Douglas Galton, K.C.B., and is here inserted for information :—

"In each province of India a Sanitary Commissioner has been appointed, who supervises the collection of statistics, formulates the results which they tend to establish, and advises the Government in matters concerning the public health. Except in the appointment of this officer, the Royal Commission's suggestion, that the sanitary administration of each province should be entrusted to a Commission of Public Health, was not carried out. Thanks to the labours of this officer, an accurate knowledge of the sanitary statistics and economy of the vast populations of India has been obtained, but that knowledge assures us that this population is decimated by epidemics, which it is within human competence to alleviate or altogether eradicate, but towards the removal or mitigation of which in India next to nothing is being attempted.

"A statistical department will do little toward sanitary improvement unless the knowledge which it renders available is duly utilised by an executive branch of the administration. In India this branch is wholly wanting, and the statistics sufficiently indicate that while the Sanitary Commissioners, by their personal observation and the intelligent formulation of the statistics collected by their subordinates, have contributed materially to increase the power of the Government in dealing with sanitary reform, there has, as a rule, been no executive action corresponding to the necessities of the case, and, in the great majority of instances, no serious attempt to carry out the improvements which the reports of the Sanitary Commissioners have shown to be indispensable.

"The very thoroughness with which the statistical portion of the work has been done has but tended to show in a more forcible manner the evil consequences of the want of an adequate executive. It is obvious that the one is the complement of the other, and the activity of each is essential to the other's usefulness. On the one hand, the duty of ascertaining the facts of the case, and the true extent and character of the evils to be met, is an indispensable preliminary to all safe and effective action. On the other, such information, however exact and well arranged, is of little practical use if no means are provided for ensuring that the suggestions based upon it are carried out with due skill, energy, and intelligence. Indeed, sanitary work must be treated as a unity; inquiry into facts forms the first stage, and the removal of the discovered defects upon a uniform system the second stage. This is the course adopted in England through the machinery of the Local Government Board. That Board has power to hold inquiries when the sanitary condition of a locality points to the necessity of inquiry, it designates the remedies required to authorise the raising of the necessary funds, and approves of the plans to be adopted.

"There is abundant evidence in this country of the benefits which have been secured by means of this system, and it is clear that a similar procedure could be adopted with enormous advantage in India. For it is in vain to hope that the numerous public bodies to which the sanitary administration of India has been committed will be found competent to discharge their important duties so long as there is no competent authority, possessing the necessary knowledge, and armed with the necessary powers, to assist their deliberations, guide their action, and, when the occasion arises, correct their mistakes or remedy their inactivity.

"It is thus clear that the necessity for a Sanitary Commission in each Presidency, such as was recommended by the Royal Commission in 1863, has been demonstrated by subsequent experience. But the creation of a department analogous to the Local Government Board in this country will not suffice for the accomplishment of the necessary reforms, unless accompanied, as it is in this country, by adequate provision for supplying the funds which sanitary improvements involve. At present no adequate provision exists; and municipalities, even as important as that of Calcutta, find it difficult or impossible to borrow in the open market.

"We have no knowledge of the considerations which led the Government of India in 1879 to abandon the system then in force, under which municipalities could borrow of the Government for approved objects and on approved security. But it may be pointed out that until resort is again made to this system or something analogous, it is hardly to be expected that the work of sanitary improvement will proceed with the continuity and rapidity that the necessities of the case render desirable.

"In the last Report of the Calcutta Municipality the Commissioners explain that regrettable delay in completing the water-supply of the city and suburbs had arisen from the difficulty which they experienced in raising the necessary funds. Some difficulty will, no doubt, be experienced still more acutely by less powerful municipalities in parts of the country remote from the great commercial centres, and unfamiliar with the transactions of the Indian money market. It is needless to point out that loans to municipalities at a slightly higher rate of interest than at which the Government can borrow, instead of being a burden to the Government, are a small source of profit.

"(Signed) Douglas Galton.

"24th August 1887."

No. 2.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commission for Madras for 1885.

1. Although this Report is the twenty-second of a series, it is, properly speaking, not a Sanitary Report. It is rather a digest of statistical data showing the losses of life from epidemic and other diseases, but with the exception of local opinions thrown into tabular forms there is little real practical information as to the causes of the year's death-rates, or as to the works and measures necessary for their mitigation or removal. It is, nevertheless, an instructive Report on the subjects to which it is devoted. All we can do, under these circumstances, is to give briefly the year's facts, and see whether they teach any and what lessons.

2. The estimated population furnishing returns of births and deaths was 28,118,178, occupying 139,900 square miles, or an average of 220·6 persons per square mile. Of the population 1,711,611 occupied 76 towns, and the remainder inhabited 51,978 villages, showing that the sanitary improvement of Madras Presidency lies in the improvement of its villages. The population element is the Native population. Including the Europeans, Eurasians, &c., the actual numbers used in calculating the ratios are 28,150,904, and we have this anomaly in vital statistics, that while the deaths among Europeans and Eurasians are left out of the calculations, the total population, including these classes, is used in deducing the ratios. This circumstance appears to have been due to absence of certain census data in 1881, while the practical result is apparently to diminish the actual death-rate.

The census population, including tracts not under registration, was 30,835,771, but the population with which we have to deal at present numbers 28,118,178.

3. In this area there were born in 1885 of males 431,352, and of females 402,690, together 824,042 births, or 29·3 per 1,000, the same rate as that of the preceding year.

4. Before discussing the deaths, we may introduce the following table showing the annual death-rates since 1869 :—

Years.	Deaths per 1,000 of Population.	Years.	Deaths per 1,000 of Population.
1869	18·3	1878	27·8
1870	18·6	1879	18·9
1871	18·0	1880	15·7
1872	16·6	1881	16·2
1873	16·4	1882	16·2
1874	17·0	1883	19·0
1875	21·1	1884	23·1
1876	23·3	1885	21·8
1877	53·2		

These ratios are obviously fallacious. The highest rates in 1877 and 1878 mark the registered deaths, but not all the deaths, of the famine period. But the other ratios merely show the state of registration in each year. No deduction can be drawn from the data as to the actual sanitary state of the people.

The highest registered death-rates of 1885 were those of Tanjore 25·7, and Madras 39·5 per 1,000.

5. The death-rate for the country districts as a whole, and out of a census population of 26,439,293, was 21·6 per 1,000 against a previous five years' average of 17·7 per 1,000. The town death-rate out of a population of 1,711,611 was 25·7 per 1,000, with a previous five years' average of 24·1 per 1,000. The death-rate for the whole Presidency was 21·8, and the previous five years' average was 18· per 1,000. The actual deaths registered were those of 317,237 males and 298,212 females, together 615,449.

6. We shall next inquire into the causes of mortality, as these are stated under the usual heads in the Report :—

Diseases.	Registered Deaths.	Deaths per 1,000.
Cholera	58,109	2·0
Small-pox	34,726	1·2
Fever	218,786	7·7
Bowel complaints	31,209	1·1
Injuries	11,659	0·4
Other causes	260,960	9·2
All causes	615,449	21·8

According to this abstract no account could be given of the death causes of above 42 per cent. of the deaths, while above 55½ per cent. of the total losses of the year were ascribed to mitigable or preventible diseases of the epidemic class.

7. We shall next discuss the statistical information given in the Report under each head, and first as regards cholera, the annual deaths from which for the last 20 years are given in the following table:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1866	200,961	1876	148,193
1867	33,505	1877	357,430
1868	8,063	1878	47,167
1869	21,034	1879	13,296
1870	55,867	1880	613
1871	17,656	1881	9,446
1872	13,247	1882	23,604
1873	840	1883	36,284
1874	313	1884	75,476
1875	94,546	1885	58,109

Cholera in Madras Presidency is made up of sudden epidemic outbursts, showing a continuous history for several years, and then a rapid decline of the disease, to be followed by a repitition of similar occurrences. We have no detailed account of the epidemic of 1866, during which upwards of 200,000 people were swept away by cholera, but the destructive outbreak of 1877-78, during which above 400,000 deaths were registered, was coincident with the famine and scarcity of those years. During these 20 years 1,325,323 people have died of cholera, or at the average rate of 66,000 a year, and if we compare the losses of the two decennial periods we find that the deaths during the first 10 years were 445,705, and during the second 879,618. Reduced to annual averages, the first 10 years give 22,220 and the second 43,900 annual deaths in round numbers. The preparation for the great epidemic of the famine time appears to have been laid in absence of rain. Otherwise it is probable that local causes remained in predisposing action much as usual, and hence the annual losses, when conveyed in ordinary language, merely imply that the epidemic was more severe or more intense. One result which follows from these comparisons is that cholera in Madras Presidency is more fatal than it was in the earlier years of the series, and that if any sanitary work has been done during the last 10 years it has not been such as to lower the cholera death-rate.

8. The cholera epidemic of 1885 was, in reality, a continuation of the revived cholera epidemic of 1884, which had declined in the month of October to 1,645 deaths. For the next two months the deaths were 3,639 in November and 19,313 in December, and the following abstract gives the monthly history in 1885:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	22,885	July	4,686
February	8,366	August	3,077
March	5,385	September	1,439
April	3,617	October	723
May	3,883	November	681
June	2,703	December	664

The large mortality in January and February in this abstract is thus explained by its relation to the cholera history of 1884.

9. The acting Sanitary Commissioner has given some interesting detail on the apparent laws of cholera prevalence in different districts of the Presidency, but it will be sufficient for our purpose to quote the following table, showing the total comparative losses from cholera during a period of 20 years in each district:—

Districts.	Deaths per 1,000 of Population.	Districts.	Deaths per 1,000 of Population.
Tanjore	62·8	Godavari	44·4
Cuddapah	59·6	Madura	41·5
Salem	58·6	Madras town	40·8
Bellary	57·8	Kistna	33·4
Trichinopoly	54·8	Nellore	31·3
South Arcot	54·7	Chingleput	25·1
North Arcot	51·6	Vizagapatam	23·4
Coimbatore	50·2	Malabar	17·1
Ganjam	48·9	Nilgiris	10·4
Tinnevelly	47·5	South Canara	9·01
Karnool	45·4		

This table contains very useful information in small compass, and yields us a sanitary working chart on which a systematic attack on the local predisposing causes of cholera might be based. It is mere repetition to say that there must be causes for these very various death-rates. But it would, no doubt, be found necessary in practice to break up each district into parts, so as to arrive at the real centres of epidemic activity, and there to grapple with its causes so far as they admit of removal.

10. Cholera prevailed over the whole area of the Presidency in 1885. Deaths from it were returned from 201 out of 230 circles of registration, and 7,385 villages out of 51,978 suffered. This fact of purely local prevalence of cholera in 1885 affords another element in the direction of preventive measures. The mortality in the country districts was 1·9 per 1,000, and in the 76 towns 3·3 per 1,000. The mortality for the whole population was 2 per 1,000 or just double the preceding five years' average. Some of the town death-rates were very high, 5, 6, 7, and 8 per 1,000 were not unfrequent ratios, while the rates in the following towns appear to call for prompt inquiry and action:—

Salur	10·2
Panruti	10·8
Cochin	10·0

If these towns and many other sufferers in the list are under local authorities, it cannot be predicated of them that they have grappled efficiently with their epidemic predisposing causes.

11. We would extend this remark to the case of Guntúr town, in Kistna, which, after many years exemption from cholera, lost 107 people from cholera in 1885. The district itself had a cholera-rate of 3·1 per 1,000 against a previous five years' rate of 0·2, so that the rate for 1885 was fifteen-fold the average. But even this great increase in epidemic severity can scarcely be accepted as a reason for the invasion of the town, provided all the sanitary improvements had been such as they were represented. It is clear that they were not enough for the district epidemic severity. In the tabular statement the cholera is attributed to importation in the face of sanitary work, but this is just one of the cases in which we would suggest a minute inquiry locally into the facts, so that a complete history, including the localities attacked, might be presented. We may repeat here the recommendation we have often made, that a special examination of exceptional epidemic cases is of great importance to the elucidation of predisposing causes. May not the existence of cesspools, as stated in the Guntúr abstract, have been a cause of the cholera outbreak?

12. *Small-pox.*—The following total annual deaths from small-pox give the statistical history of this disease for a period of 20 years:—

Years.	Total Small-pox Deaths.	Years.	Total Small-pox Deaths.
1866	23,106	1876	23,469
1867	27,907	1877	88,321
1868	34,330	1878	56,360
1869	17,448	1879	17,840
1870	11,252	1880	14,529
1871	20,823	1881	15,776
1872	39,074	1882	20,159
1873	51,784	1883	37,975
1874	48,343	1884	61,247
1875	24,775	1885	34,726

In this abstract we can easily trace the great small-pox epidemic which accompanied the famine of 1877–78. During the next four years there was a marked decline in deaths from this disease until 1881, when a new epidemic period began to show itself. In 1884 deaths from small-pox numbered 61,247, and in the year under review the mortality had decreased to 34,726. The year's death-rate was 1·2 per 1,000, and the previous five years' average rate was 1· per 1,000.

13. It is important to show the ages of small-pox deaths on account of the relation of this element to vaccination.

These ages were as follows:—

	Deaths.
Under 1 year	5,774
1 year and under 12 years	12,711
Above 12 years	16,241

Above one-half the deaths took place at ages under 12, and a sixth part were under one year of age, showing the need of extension of vaccination at the earlier ages.

14. Deaths from small-pox were returned from all the circles of registration with seven exceptions only, but the number of attacked villages is not stated in the returns. Out of 76 towns, 54 returned deaths. The same death-rate, 1·2 per 1,000, ruled both among the town and country population.

15. The monthly deaths were as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	4,421	July	2,157
February	4,662	August	1,812
March	5,471	September	1,516
April	4,477	October	1,341
May	3,601	November	1,401
June	2,428	December	1,439

16. *Vaccination.*—The vaccination staff employed during the calendar year 1885, including the municipal vaccinators, consisted of,—

Inspector of vaccination and deputy sanitary commissioner	1
1st class deputy inspectors	34
2nd class ditto	16
1st class vaccinators	244
2nd class ditto	354
Probationers	119
Peons	49
Total staff	817

The population among which the staff carried on its work according to 1881 census was 30,868,504. The total number of vaccinations performed during the calendar year was 742,863. Of these 729,213 were primary vaccinations, and 13,650 were re-vaccinations. Of primary vaccinations 690,619, or 94·7 per cent., were reported as successful, and of re-vaccinations 7,961, or 58·3, were successful. The successful vaccinations amounted to 22·3 per 1,000 of the population. The corresponding average for the preceding six years was 19·6 per 1,000, and the average deaths from small-pox for the same period were ·9 per 1,000. The successful vaccinations under one year of age were 138,287, and those over one and under six years were 373,155. When the successful vaccinations are compared with the births some allowance would have to be made for difference of population, which, as we have already seen, was for vaccination 30,868,504. But the population returning births was 28,118,178, and the births registered were 824,042, or more than six-fold the number vaccinated under one year age.

While fully recognizing the epidemic character of small-pox in this Presidency, and the necessity of increased activity in the removal of local predisposing causes of epidemics generally, it seems not out of place in the face of the facts to advise a more persistent spread of vaccination at the earlier ages. Madras town itself is deficient in both of these matters, and the Acting Sanitary Commissioner calls attention to the experience of the late three years' epidemic period of small-pox, which swept away 5,959 of its people, although only 25 of the deaths took place in 1885.

17. *Fevers.*—Diseases classed as "fevers" have yielded lower death-rates in Madras Presidency than in other districts of India. It is impossible to say how far this circumstance may be due to difference in nomenclature, but the registered deaths for 20 years will show what have been the registered facts:—

Years.	Registered Fever Deaths.	Years.	Registered Fever Deaths.
1866	110,102	1879	230,092
1867	112,511	1877	469,241
1868	105,692	1878	374,443
1869	132,346	1879	285,477
1870	151,027	1880	209,940
1871	192,469	1881	203,542
1872	214,148	1882	188,561
1873	222,843	1883	203,786
1874	226,220	1884	215,977
1875	252,042	1885	218,786

The years of exceptional mortality, 1877 and 1878, were the famine years, and excluding these, the annual fever deaths appear to remain tolerably constant at 200,000. We may, therefore, assume the data for 1885 as giving an approximate account of fever prevalence at ordinary times in the different districts and towns of the Presidency.

18. In 1885, fever prevailed over the whole area of Madras, and every one of the 230 registration circles suffered. The death-rate assigned to this cause was 7·7 per 1,000, against a previous five years' rate of 7·1 per 1,000. The fever death-rate in the country districts was 7·9 per 1,000, and in the towns 5·2 per 1,000. The number of affected villages is not stated, but probably none escaped, and from only one town out of 76 no fever deaths were returned. The usual district death-rates were between 5 and 9 per 1,000, but in the following instances the rates have been so persistently high that it appears necessary to call attention to them :—

Districts.	Fever Deaths per 1,000 of Population.	
	1885.	Previous 5 Years' Average.
Ganjam	10·7	10·9
Vizagapatam	13·7	11·7
Kurnool	16·2	15·2
Cuddapeh	13·0	11·7
Nilgiris	13·3	10·3

Cases of this kind obviously should be dealt with if there were a competent sanitary engineering department to take them up. The town fever death-rates were generally lower than the district rates, but some of them were also high.

Among these higher rates were the following :—

Vizianagram	10·2 per 1,000.	Tirupati	18·6 per 1,000.
Bobbili	10·5 „	Ambur	13·9 „
Salur	13·5 „	Ootacamund	10·9 „
Gudiyatam	17·5 „		

We can only repeat the same remark about these town rates, namely, that they should be dealt with.

19. The following were the monthly deaths from fevers :—

Months.	Registered Fever Deaths.	Months.	Registered Fever Deaths.
January	20,481	July	20,432
February	16,562	August	19,998
March	16,586	September	18,439
April	15,845	October	17,634
May	16,015	November	19,290
June	16,888	December	20,616

This table shows the usual relation between drying up and changeable temperature and the amount of fever. But none of the more severely affected districts, except the Nilgiris, had a rainfall above the average. Hence the probability that causes of fever mortality must be sought in the localities.

As the account of fever in this Report is a purely statistical one, it affords us no help in determining or dealing with its causes.

20. *Bowel complaints.*—The Report gives the following past statistical history of bowel complaint mortality for a period of 15 years :—

Years.	Registered Deaths from Bowel Complaints.	Years.	Registered Deaths from Bowel Complaints.
1871	38,928	1879	23,218
1872	39,387	1880	19,622
1873	36,392	1881	18,961
1874	37,993	1882	19,958
1875	37,484	1883	22,098
1876	38,176	1884	28,775
1877	133,366	1885	31,209
1878	48,053		

In this abstract we again find the traces of the famine and scarcity of 1877–78, in the enormous mortality from the famine diarrhœa and dysentery. Thereafter there was a considerable falling off in the mortality, and for the last three years there has been a considerable increase in the number of deaths, marking apparently the return of former averages. The 31,209 deaths in 1885 represented a death-rate of 1·1 per 1,000 against a previous five years' average of 0·7. Deaths were returned from 227 out of 230 registration circles, but the number of attacked villages is not given in the

returns. The Madras registration circle yielded the highest bowel complaint death-rate of the year, namely, 7 per 1,000, against a previous five years' average of 5·6 per 1,000. Out of the 76 towns 64 returned deaths under this head. The country district death-rate was 1 per 1,000, and the town rate 2·6.

21. The monthly mortality was as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	3,975	July	3,150
February	2,559	August	3,090
March	2,279	September	2,482
April	1,872	October	2,367
May	2,025	November	2,576
June	2,106	December	2,728

The population of Madras city itself has suffered most from fatal bowel diseases, and the mortality appears to be increasing. In 1881 it was 4·9 per 1,000, and in 1885 it had gradually risen to 7 per 1,000. The Acting Sanitary Commissioner very properly describes this death-rate as "excessive, and indicative of foul air, over-crowding, bad drainage, and probably, in some cases, "the use of water polluted with sewage." As regards the death-rates generally from those diseases, he says, "the chief predisposing causes of bowel complaints are general insanitary conditions, "especially bad water and foul air; and the deaths under this head will no doubt diminish as the "sanitary condition of towns and villages is improved."

We accept this view of the case entirely, but apparently to do so unreservedly would be to beg the whole question at issue, which is simply the prospect we have of sanitary improvements being carried out by present methods.

Madras itself has been under municipal management, so-called, for about a quarter of a century, and we have seen with what results. It ought never to be forgotten that local engineering inspections, plans of works to meet sanitary necessities economically, and proper execution of works are as much specialities as the work of the Sanitary Commissioner in preparing disease statistics and estimating disease causes and their local conditions is a specialty.

22. *Injuries.*—The following were the deaths from injuries in 1885 :—

Suicides	1,573
Wounds	901
Accidents	6,815
Snake-bite and wild beasts	2,370
	11,659

The mortality was about the average of recent years.

23. *All other causes.*—Under this head were registered 260,960 deaths, and the proportion is increasing. Under this head no further remarks are required.

24. Under Section VIII. of the Report is given the usual general account of the health of British and Native troops, sanitary works, &c., which may be abstracted briefly as follows :—The strength of British troops on 1st January 1885 was 11,220, and after accounting for the year's increases and decreases the strength on 1st January 1886 was 11,775. The admission-rate in 1885 was 1,163·3 per 1,000, the daily sick 66·1 per 1,000. The death-rate was 9·2 per 1,000, a little in excess of the rate of 1884, which was 8·5 per 1,000. The invaliding ratio was not available.

25. The most numerous admissions are those from paroxysmal fevers, and in the following abstract we have placed the aggregate admissions from these fevers for eight years for each station. The ratios are not included, but the numbers show clearly the relative prevalence of intermittents at each station, and where the causes are to be sought for and dealt with.

Stations.	Aggregate Admissions, 8 Years.	Stations.	Aggregate Admissions, 8 Years.
Bangalore	988	Ramandroog	99
Bellary	2,328	Rangoon	2,065
Cannanore	86	St. Thomas Mount	78
Calicut	10	Secunderabad	1,738
Kamptee	3,340	Seetabaldee	291
Madras	151	Thayetmyo	475
Mahapuram	8	Tounghoo	285
Poonamallee	171	Wellington	808
Pallaveram	6	Mondoungee	9
Port Blair	143	Belgaum	8

It may be safely stated at Bellary, Kamptee, Rangoon, and Secunderabad, which yielded 9,471 admissions from intermittent fever, out of 13,179, there are causes which might, with advantage to the Army, be inquired into, as as far as possible remedied. Admissions from ague numbered 713 in 1885. There were 50 admissions from remittent fever.

The most fatal fever of the year was as usual enteric fever, from which there were 73 cases and 23 deaths. Of the cases 29 and 10 deaths took place at Secunderabad. There were six cases of cholera and two deaths. Four of the cases took place at Secunderabad.

Diarrhœa yielded 429 admissions, and dysentery 562, of which only four proved fatal. There were 384 cases and 14 deaths from hepatic diseases.

26. Venereal diseases still continue to rank amongst the most common causes of inefficiency, and the admission-rate from them, which was 308·3 per 1,000, was the largest on record. The admissions from all causes numbered 12,090, and the deaths 96, and of these 3,199 admissions and 2 deaths were due to venereal diseases.

27. *Women and children.*—The average strength of women was 900, the admissions 877, and there were 12 deaths, or 13·3 per 1,000. The children numbered 1,851, and the admissions 1,175, out of which 59 died. The death-rate among women was 13·3, and for children 31·8 per 1,000. Both rates are better than those of former times.

28. *Native Army.*—This army numbered 29,120 on 1st January 1855, which was nearly the year's average. The admission-rate was 660 per 1,000; the daily sick 28·9 per 1,000. The death-rate in hospital was 7·8, and out of hospital 1·4 per 1,000. The chief cause of the lower admission rate among Native than among European troops must be attributed to the low rate from venereal diseases, which among Native troops was 17·2 per 1,000 against 308·3 per 1,000 among Europeans. Of the aggregate admissions to hospital among Native troops, which were 660 per 1,000, 213·4 per 1,000 was due to intermittent fevers. The statistics of both armies, except in the matter of venereal diseases, are by no means unsatisfactory, while they show the results of increasing attention to the health of stations, and to the sanitary management of troops.

29. *Sanitary Reports, Military.*—Under this head are given brief abstracts of 30 stational reports. They convey very little information of a practical kind, but generally they convey the impression that, although little advance has been made in sanitary work during the year, the previous condition of the stations has been fairly maintained.

Bellary had had its water supply improved by an artesian well.

At *Bangalore* the Ulsoor and Shoolay tanks had been deepened, and a drainage improvement effected. Nothing is said of obtaining water from a purer source.

At *Cannanore* drains and tanks were cleaned and repaired.

The drainage of *Kamptee* had undergone no improvement since last report.

At *Malliapuram* barrack rooms for 50 European soldiers were constructed.

The drainage of *Secunderabad* was still defective.

At *Vizagapatam* drainage and water supply were improved.

There is nothing further in these abstracts requiring notice.

30. *Sanitary works, Civil (Jails).*—If any evidence were required to prove that if in India sanitary principles be not simply enunciated, but intelligently applied, they will lead to successful results, this evidence would be found in the history of Madras jails. Amidst much that is so unsatisfactory as almost to justify doubts as to the efficacy of sanitary work in protecting health in tropical climates, we can at least point to the results in the European and Native armies, and among the jail population, which last includes many individuals who could find no place in the ranks.

31. Following our usual course, we shall first give the jail death-rates for a period of 21 years :—

Years.	Ratios per 1,000 Strength.	
	Admissions.	Deaths.
Five years to 1869	1045·3	76·1
1869 to 1874	702·0	24·3
1874 to 1879	852·5	87·5
1880	854·0	44·7
1881	742·5	41·4
1882	800·4	41·9
1883	865·3	29·4
1884	769·5	20·2
1885	701·9	17·4

The high death-rate in the period 1874 to 1879 includes the famine period, when a great many prisoners entered the jails in a state of starvation and suffering from famine diseases. Even at present the lower death-rates are not due to improved character in the committals, for the Report informs us that "in jails generally, of all causes of death, general debility was the most common."

We shall next show in what death causes the reductions in mortality have taken place. This part of the jail history is shown in the following table:—

Periods.	Deaths per 1,000 Strength.				
	Cholera.	Dysentery.	Diarrhœa.	Dropsy.	Anæmia.
1861–62	26·3	8·5	14·6	—	—
1862–63	23·0	7·2	14·5	—	—
1863–64	15·6	16·5	17·5	—	—
1864–65	21·3	18·2	30·9	—	—
1865	30·0	12·8	22·7	—	—
1866	25·5	14·3	34·6	—	—
1867	0·8	8·8	10·5	5·3	12·1
1868	0·2	5·5	7·3	1·9	5·7
1869	4·3	6·6	7·3	3·3	2·4
1870	1·5	3·6	4·6	1·6	1·5
1871	0·7	3·9	2·3	0·8	0·3
1872	1·3	3·9	4·5	0·9	1·2
1873	0·1	5·9	6·0	2·5	0·4
1874	—	5·3	5·3	1·9	0·9
1875	4·1	6·4	7·7	3·5	0·9
1876	10·0	7·7	5·3	2·2	0·9
1877	25·7	32·1	5·1	5·8	2·0
1878	5·1	15·0	28·2	13·1	1·2
1879	1·4	10·3	10·2	5·9	0·9
1880	0·08	10·1	8·9	4·5	0·9
1881	3·2	8·9	6·8	2·9	0·4
1882	3·2	8·7	9·8	2·6	0·9
1883	1·9	3·8	5·8	1·5	0·5
1884	0·9	1·2	3·1	1·1	0·4
1885	0·4	1·5	1·5	0·9	0·4

32. The two last columns in this table include facts connected with the general health and ages of prisoners, but they also show the results of improved dieting and management of prisoners. The most remarkable reduction in death ratios are, however, those from epidemics, shown in the first three columns, and it may be remarked that the sudden increase in 1876–77 and 1878 mark the famine and scarcity period, which began to show itself in the last quarter of 1876. In the later years of the series of reductions in death-rates under these heads show the results of good executive measures, and we should rejoice to have similar experience from the civil population outside jails, such as has been supplied by the part detached and shut up within prison walls.

Of course the jails are not all they ought to be or may become under further improved management. But we concur with the view of the Acting Sanitary Commissioner, that "such immunity "is highly creditable to the sanitary state of our prisons." If this be true, what can be said of the sanitary administration outside the prison walls?

33. We shall next give briefly the facts for the year 1885.

On the 31st December 1884 there were 6,956 prisoners in jail. In 1885 the additions amounted to 16,457, and the reductions were as follow:—

Liberated	13,284
Transferred to other jails	2,560
Transferred beyond sea	78
Escaped	21
Died	127
Executed	33
Total decrease	16,103

The year ended with a jail population of 7,307. The average strength of prisoners in 1885 was 7,036. Out of this number the admissions to hospital were 4,939, or 701·9 per 1,000, and the deaths numbered 123, or 17·4 per 1,000. Among the deaths were 3 from small-pox, 1 from intermittent and 4 from remittent fevers, 3 from cholera, 19 from respiratory diseases and phthisis pulmonalis, 22 from dysentery and diarrhœa, 11 from each cause, and 10 from atrophy, anæmia, and dropsy.

Many of the prisons, it must be remembered, are situated in places where the civil population suffers severely from epidemics, the local causes of which have been unremoved. As usually happens the year's death-rates varied considerably in different jails, showing where inquiry and improvement are most needed.

34. *Municipalities.*—Including the city of Madras, there are 48 localities under municipal government, one of the chief functions of which is, or ought to be, the protection of the people from epidemic diseases. Madras has its own municipal Acts and issues its own report. The estimated population of these municipalities was 1,745,354, and their average death-rate (which includes that

of Madras) for 10 years has been as follows, premising, however, that the rates of 1877 and 1878 include the losses due to famine :—

Years.	Death-rates per 1,000.	Years.	Death-rates per 1,000.
1876	32·8	1881	28·1
1877	69·1	1882	28·0
1878	38·5	1883	30·0
1879	29·8	1884	34·0
1880	26·6	1885	29·9

The ratio of 1885 was slightly above the preceding five years' average, which was 29·3 per 1,000.

35. The diseases which afford the most reliable test of sanitary condition in India as elsewhere are those of the epidemic class, and we shall next show the deaths from these for the same group of years :—

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.
1876	52,564	9,430	2,086	8,576	5,608
1877	110,388	19,631	11,592	14,049	30,020
1878	62,428	3,794	2,908	14,435	13,195
1879	43,305	672	2,091	13,182	6,785
1880	43,051	36	1,892	11,298	5,756
1881	45,373	1,931	2,349	11,274	4,920
1882	45,296	3,512	2,392	9,947	5,076
1883	51,994	4,878	4,555	10,366	5,909
1884	58,989	7,172	7,689	10,668	6,464
1885	52,258	4,576	1,699	10,605	7,155

This abstract shows that the great increase of mortality during the famine and scarcity years was in the municipalities as elsewhere due to epidemic diseases, but it also shows that, excluding the famine, there has not only been no reduction in the extent to which these diseases prevail, but on the contrary, they have shown a tendency to increase. It follows, if the statistics are approximately reliable, that whatever may have been the amount of municipal sanitary work it has not reached the local predisposing causes of epidemic and endemic diseases.

36. *Sanitary Works.*—There are two accounts of the amounts spent on sanitary works in 47 municipalities (exclusive of Madras), one for the official year 1884–85, and the other for the last nin months of 1886. We shall abstract the details for the completed year as follows :—

	1884–85. Amount spent.
	Rs.
Conservancy	3,72,809
Town sites	30,084
Cleansing, repairing, and construction of tanks and wells	61,007
Fairs and festivals	8,940
Markets and slaughter-houses	36,323
Latrines, dust-bins, drains, &c.	54,653
Total Rs.	5,63,816

or about 10*d.* per head of the population, excluding Madras.

37. The sanitary staff and material at work during the year was as follows :—

Establishment.	Number.	Material.	Number.
Inspectors	133	Carts	1,029
Overseers	35	Dust-bins	6,667
Maistries	66	Public latrines	896
Peons	185	Private latrines	19,204
Sweepers	3,131		
Tank watchers	111		
Total staff	3,661		

It will be observed that this establishment and material is intended mainly for conservancy purposes, but no account is given of any officials employed in designing or executing local sanitary works, and it happens that the tabular abstract of municipal sanitary works, although defective in many

matters in which information would be useful in arriving at the local causes of epidemics, does tell us in a few words the things which have not been done under the present arrangements.

38. Generally speaking, conservancy is reported to be done with more or less efficiency, but in some cases very imperfectly. In a few cases wells and tanks have been improved, but it cannot be said that much of importance in this branch of public health work has been done. As regards drainage, it appears to be generally absent, and this defect means damp sites, subsoil pollution, damp houses, bad water, and foul air to breathe. Until these disease causes are grappled with and removed municipal disease statistics will remain much as they are.

39. The Acting Sanitary Commissioner appears to have been himself impressed with the existence of these defects in the sanitary executive, for he says:—"During my inspection tours the need for a "sanitary engineer, specially qualified to give advice to local bodies with regard to water-supplies "and drainage, was frequently impressed on me, and there seems strong reason to believe that if such "an authority were available a great impulse would be given to sanitary works. Many municipalities "are at present deterred from entering on such projects for the want of a thoroughly qualified "sanitary engineer who would assist them in carrying out schemes of improvement at a practicable "cost. The subject was referred to the Government after the close of the year, and will be practi-"cally alluded to in next year's Report." But we now know from the subsequent published proceedings that the Government declined to entertain the proposal at present. If the advice of the Royal Commission of 1859 had been followed, Madras Presidency would have had a commission of health, including in it all the elements necessary for giving practical effect to well known sanitary principles, but unfortunately their recommendation was not followed, and the epidemic death-rates we have discussed in the preceding paragraphs, the executive necessities pointed out by the Acting Sanitary Commissioner, and the reply of the Government bring the history down to the present time.

40. There is one other subject on which a single remark may be made, and this is the frequent change of Sanitary Commissioners, a course of proceeding destructive of efficiency if the duties to be performed were proper sanitary duties, but of less importance, as the present excellent Report shows, when the duties are confined to statistics. To deal with a diseased town or village is closely allied in principle to dealing with a patient at the bed side, and the proper discharge of both functions requires knowledge, experience, and technical skill, all of which require time for their acquisition. In our Memorandum on last year's Madras Report, we stated that the then Sanitary Commissioner had just come into office when he was called on to prepare it. During January and February he was in charge, but was relieved in March, and did not take permanent charge till the 8th April (1885), and the present Acting Sanitary Commissioner now tells us that he entered on his turn of office on 14th April 1886. This is certainly no part of the arrangement advised by the Royal Commission of 1859. What they recommended was, that a trained sanitary member should be permanently part of the Sanitary Commission, to assist the technical sanitary executive, which at present has no existence in any Indian Government. The facts speak for themselves.

41. *Local fund circles.*—There are 21 of these circles, corresponding to the 21 districts of Madras Presidency, and their function is as far as possible to provide for the sanitary wants of the country population, "by the improvement of village sites and water-supply, for sanitary arrangements during "fairs and festivals, for the scavenging of small towns and large villages, for the construction and "repair of markets, slaughter-houses, latrines, dust-bins, and drains, and other measures calculated "to promote the health, comfort, and convenience of the people." These measures involve the sanitary improvement of 51,930 villages and small towns, and the district population amounted in 1881 to 26,439,293. A small number of the population groups is "conserved" every year, 565 in 1884–85, and 557 during the year under review. Hence, at the present rate of progress, about a century would be required to do the work once, while in sanitary practice the work has to be carried out from day to day, and always.

42. The available funds for these purposes are one third of the land cess, and of this sum 24·7 per cent., was spent during the completed year 1884–85, as follows:—

	Rs.
Conservancy	1,56,263
Village sites	12,790
Cleansing, repairing, and constructing tanks, wells, &c.	54,657
Fairs and festivals	10,282
Markets and slaughter-houses	47,504
Latrines, dust-bins, drains, &c.	24,042
Total	3,05,538

or about 30,000*l.*

43. The Sanitary Commissioner reports the year's work as follows:—"The sources of water-supply "and the system of drainage and conservancy were the same as those described in former Reports. "Improvement of water-supply now receives greater attention year after year. . . . Scaven-"gering establishments were maintained in small towns and large villages adjoining the head-quarter "stations, from where supervision can more properly be exercised. Generally speaking, they are of "some service so far as surface cleansing is concerned; but the greatest evil to cope with is the

" conservancy of the interior of private dwellings, where sanitation has yet to make its way in. In " some few districts the establishments are too small and supervision imperfect to be of any practical " value." In a few large villages sanitary associations supervise the cleansing.

The district reports are given in a statistical abstract, which agrees with the views of the Sanitary Commissioner above stated, but the most certain test of the efficiency or inefficiency of sanitary work is that contained in the vital statistics of the districts, which clearly show that the present method of providing for the sanitary necessities of the mass of the people are quite inadequate to the necessities, although in principle and with the aid of a more effective executive machinery good might be effected by them.

44. *General Remarks and Personal Proceedings.*—Under this section there are several points discussed which require notice. In February the Sanitary Commissioner, at the request of His Excellency the Commander-in-Chief, made an inspection of part of the margin of the Hussain Saugar tank at Secunderabad, near the quarter occupied by the divisional staff and other officers, where an open sewer conveys the town sewage "in a black seething stream, till lost in the water of the tank. " The smell from this current was simply overpowering, and was said frequently to induce nausea " and vomiting amongst the tenants of the staff lines." Has this disease cause any connection with the prevalence of enteric fever and cholera among troops at this station? This nuisance was to be dealt with, but such a state of matters near a military station in a hot climate is certain to lead to epidemic attacks.

Following the example of Pondicherry, attempts had been made to obtain water from artesian wells at other stations on the Coromandel coast, and without success. The geologists would be able to tell whether the stratification was the same, and if so the probability would be that the boring had not been conducted on the same principles.

45. On the subject of house cleansing in municipal towns the Government had made inquiries, with the important result, " that the real secrets of a successfully worked system seem to be, effective " arrangement, a low scale of fees, and a vigorous prosecution in cases where under private manage- " ment latrines and drains are not kept in proper order." Considerable progress had been made in this matter during the year. The Sanitary Commissioner further insists on the necessity of schools and colleges being under sanitary supervision, and that teachers should help in the work of sanitation.

The special measures dwelt on by the Sanitary Commissioner as necessary for improving the public health are:—

(1.) Burning of town refuse, and avoiding collections of manure among dwellings.
(2.) Better provisions for stalling cattle.
(3.) Improved town building arrangements for preventing overcrowding, and other results of this disease cause.
(4.) Inspection of articles of food.

But these measures by no means cover the whole ground. This is shown by the continuous sanitary history of the province, which has long since revealed the fatal effects on the health of the people of foul undrained subsoils, damp houses, and polluted wells, consequent on this condition of the subsoil. The remedies required are equally well known, but we may here repeat them. They are such measures for draining the subsoil as may be practicable in each case; raising house floors sufficiently above the damp ground level; protecting wells and water sources from the influx of foul drainage, and generally the adaptation of well known sanitary principles to specific cases, and it is in this direction that a proper sanitary executive, with the requisite knowledge and means of execution, would save life and working power to the population, especially in the villages, where the real sanitary problem lies.

Lastly. In the preceding paragraphs we have confined ourselves to a statement of facts, showing what is the sanitary condition of the people of Madras Presidency, after attempts at improvement along particular lines. No one conversant with the past Reports of Sanitary Commissioners can entertain any doubt of the desire and intention of the Government to deal effectively with the sanitary improvement of the people. But after 22 years' experience we are met by the facts already stated, which show that no appreciable result has as yet been attained. Where the defects in the means of execution are to be found is evident enough, and the choice now appears to be between submitting to the present epidemic death-rates, and all they represent of loss of life and working power and property, and making a strenuous effort to introduce an efficient sanitary administration for the whole Presidency.

23rd March 1887.

No. 3.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the GOVERNMENT of BOMBAY for 1885.

1. The present year's Report is almost exclusively devoted to a detailed analysis of births and deaths covering the entire area of the Presidency, and to similar details regarding the vaccination service, but it can scarcely be said that it affords any satisfactory amount of the sanitary relations of localities to the local death statistics, unless this can be deduced by careful statistical comparisons between the present and former data.

2. So far as concerns the new registration arrangements, these appear to be working satisfactorily, and the registration generally, with a few exceptions, appears to be making progress towards greater accuracy.

3. We propose in the first place to give a brief review of the year's facts; to deduce from them the year's sanitary history; and then to consider any information on this latter subject which the report contains.

4. *Births.*—During the year 1885 there were registered the births of 298,406 males and 274,025 females, together 572,434 children, or 37,708 births in excess of the registered number of 1884. That great improvement in record is being gradually attained is further shown by the fact that the number registered in 1885 exceeded the preceding 10 years' mean by 183,681.

The birth ratio, calculated on the population of 1881, which was 16,454,414, was for males 18·14, and for females 16·65 per 1,000, making together a birth-rate of 34·79 per 1,000, without allowing for the reducing influence of population increase.

Birth registration is least advanced in Sind district and in Bombay city, where the birth-rate was only 18·99 per 1,000, about one per 1,000 under the Sind rate, which was 20·20 per 1,000. Notwithstanding these deficiencies, the high average rate of 34·79 per 1,000 for the whole Presidency shows that good work has been done in 1885.

As regards Bombay, the Sanitary Commissioner makes the following recommendation, in the need of which we concur:—"The measures taken by the Municipal Commissioner to ensure a correct "registration of births are evidently inadequate for the purpose, and as it is one of importance I "hope Government may be pleased to call his especial attention to the subject, as it is certainly not "right that the leading municipality in this Presidency should occupy such a very low place on the "list of towns as regards registration of births." We are glad to see that the Government has expressed similar views in their resolution.

The birth registration reproduces some unexplained facts. For example, the town population of 2,105,756 yielded a birth-rate of 26·17 per 1,000, while the rural population of 14,348,658, where the registration machinery could scarcely have been so effective, returned a rate of 39·90 per 1,000. In the same way, while the town average fell below the country average, certain of the town rates were very high, lying between 4½ and 5 per cent. The cantonment birth-rates were between 16 and 36·83 per 1,000, the average being still below the normal rate.

5. *Deaths.*—The deaths registered in 1885 included those of 248,829 males and 224,762 females, together 473,591, yielding a death-rate for the Presidency of 28·78 per 1,000. The preceding year's rate was 24·82, and the decennial mean 25·58 per 1,000; but it does not follow that there was an increase of three or four per 1,000 in 1885 on the actual death-rate. The apparent increase is mainly due to improving record of deaths. Thus, in 1875, there were 375,718 deaths entered on the registers, and in 1885, as we have seen, the reported deaths were 473,591, while during the intervening years the registration has been improving so that the figures cannot be accepted as indicating declining health.

The best registration work in 1885 appears to have been done in East Gujarat, where the death-rate reached 32·31 per 1,000, while in Sind district it was only 19·72 per 1,000.

Although the total death-rate of the province, 28·78 per 1,000, cannot be said to be unsatisfactory so far as the present registration methods are concerned, the rate cannot be accepted as showing by itself what is the actual sanitary condition of the people.

Taken by collectorates, the death-rate was lowest in Thar and Parkar, where it was 14·51 per 1,000, and the highest rate of the year, 37·90 per 1,000, was returned from Broach. The comparative town and district death-rates were as follows:—

92 *Towns.* Population, 2,094,180; death-rate per 1,000 28·27.

29 *Districts.* Population, 14,348,658; death-rate per 1,000 = 27·17.

6. *Causes of death.*—The following abstract shows the death causes in 1885, compared with the mean numbers for the preceding ten years:—

Causes of Death.	Mean of Ten Years, 1875–1884.		1885.	
	Number.	Ratio per 1,000.	Number.	Ratio per 1,000.
Cholera - - -	26,765	1·64	37,287	2·27
Small-pox - - -	7,923	0·49	2,646	0·16
Fevers - - -	272,712	16·71	314,237	19·10
Bowel complaints - -	34,952	2·14	45,056	2·73
Injuries - -	6,384	0·39	5,577	0·34
All other causes - - -	68,697	4·21	68,788	4·18
All causes - -	417,433	25·58	473,591	28·78

It will be seen that the deaths registered under the head of "all other causes" have remained constant, and that the chief addition to the deaths comes under the head of "fevers," a classification which cannot be admitted as correct. But nevertheless, we find that the ten years' average fever death-rate, which was 16·71 per 1,000, and became 16·83 per 1,000 in 1884, rose suddenly in 1885 to 19·10 per 1,000, accounting for nearly the whole increase in the mortality of that year, a result which we should scarcely be justified in ascribing solely to better registration. It is possible that fever mortality may have increased, but this is about all that can be said.

7. The case is somewhat different with the better known and better defined epidemics of cholera, small-pox, and bowel complaints (diarrhœa and dysentery). The ten years' average cholera death rate, which had been 1·64 per 1,000, became 2·27 per 1,000 in 1885, which means that in 1885 the cholera deaths were 10,522 above the average; but when compared with tho 13,804 deaths from this epidemic disease returned in 1884, we find an increase in the cholera deaths in 1885 of no fewer than 23,477. The deaths from bowel complaints had increased more than 9,000 above the average, but there had been on the other hand a reduction in the small-pox death-rate. The ten years' average mortality from this epidemic, which had been represented by 7,923 annual deaths, suddenly rose to 14,438 deaths in 1884, and then declined to 2,646 deaths in 1885.

8. The most important sanitary result of these statistical facts is simply that Bombay Presidency is an epidemic region within which the predisposing local causes are always more or less active, and that when an epidemic period comes round, which it is certain to do in its own time, the people must suffer because the local causes are permitted to exist among them. In some years they may suffer less than in others, but the death penalty is certain to be exacted sooner or later, and with it comes always loss of working power, and consequently of wealth to the State.

These economic relations of epidemic diseases are now so generally known and acknowledged that it is scarcely necessary to insist on their importance.

9. We shall next abstract from the Report a few facts regarding each epidemic death cause, beginning with,—

Cholera.—Experience of 1885 confirms all preceding experience in showing that in Bombay Presidency cholera is a purely epidemic disease, and that while its incidence is determined by epidemic causes, its fatality is the result of local conditions. The statistics, as a whole, can scarcely be accepted as showing the actual annual deaths from cholera, because registration has been improving, and no doubt more deaths are being registered, but no improvement in this detail can alter the facts actually registered in this table, which gives the annual losses of life from cholera for two decennial periods:—

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1866 - -	23,027	1876 - -	32,117
1867 - -	5,143	1877 - -	57,252
1868 - -	6,347	1878 - -	46,743
1869 - -	52,230	1879 - -	6,937
1870 - -	2,666	1880 - -	684
1871 - -	5,821	1881 - -	16,694
1872 - -	15,642	1882 - -	7,904
1873 - -	283	1883 - -	37,954
1874 - -	37	1884 - -	13,804
1875 - -	47,555	1885 - -	37,287
Total - -	158,751	Total - -	257,370

The facts show that, whatever improvements in record may have been attained, cholera is a much more fatal disease in Bombay than it was in former years.

10. The epidemic history of Bombay is unfortunately only part of the epidemic history of India; and as we now know that, although we cannot control the course of an epidemic, we can diminish or prevent the great destruction of life and prosperity which its ravages entail, we can arrive at no other conclusion from the facts as a whole than that something which might have been done in the past towards this object has been left undone. It is one of the characters of epidemic diseases that if their local causes are not removed they have a tendency to become cumulative, and hence more difficult to deal with, and this result of past inaction is sure to manifest itself by increase of mortality such as is shown in the preceding table.

11. In 1885 cholera prevailed generally over Bombay Presidency, but its severity was much greater in some areas than in others. Out of 283 registration circles 234 returned deaths from it; but the outbreaks were strictly local, and were confined to 3,733 villages out of 40,894 in the Presidency. This single fact gives a clue to the whole sanitary method of dealing with cholera, for it shows conclusively that while the epidemic, as such, was present over the whole country, its incidence was determined by causes strictly local. What these causes are is now matter of common knowledge, but why they have been left year after year to do their deadly work when the time comes round is another matter, and which apparently demands strict inquiry.

12. The 62 towns, with 19 exceptions, yielded 4,038 cholera deaths, or 1·93 per 1,000 of the town population of 2,094,180, a result apparently showing that sanitary work had been done, whereas in the country districts, which have a population of 14,548,658, there were 33,249 deaths, equal to a death-rate of 2·32 per 1,000. The rates varied greatly in different districts and towns. The highest district rate of the year was that of Karachi, namely, 10·63 per 1,000 for the district. The town rate was 2·75 per 1,000. The highest town rate was 28·39 per 1,000, in Pandharpur, where out of 16,910 people 480 died of cholera, a fact which by itself ought to be examined into and its causes shown. Sholapur district, in which this town is situated, had a cholera death-rate of 3·69 per 1,000, while Sholapur town had a rate of 0·48 per 1,000. There is no escape from the responsibility which facts such as these involve.

13. The monthly mortality from cholera was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	799	July	11,450
February	743	August	4,834
March	1,294	September	1,690
April	1,144	October	1,689
May	3,481	November	654
June	9,310	December	199

It thus appears that there was an entire epidemic which has passed over from the last quarter of 1884.

14. The Sanitary Commissioner has given much useful practical statistical information on local epidemic history, if it were only turned to practical account. The usual insanitary conditions in towns and districts are taken for granted, and he concludes his account of the cholera of 1885 as follows:—
"Putting aside for the present all questions as to the etiology of cholera, the lesson to be learnt from "this epidemic is that all measures taken at the time of an outbreak of cholera can only be palliative. "The real remedy is to insist on sanitary measures being introduced, so as to ensure cleanliness in "every village at all times, irrespective of epidemic times and seasons. If this were only understood "and acted upon, cholera and other diseases would lose their intensity, but nothing short of this "action will prevent epidemics."
This is quite true, and admits of no doubt whatever, but unfortunately, whether the subject has been understood or not by executive authorities, there is also no doubt that the knowledge has been put to no real practical purpose up to the present time. The epidemic itself is the real sanitary inspector, and the latest result of its oversight has been, as we have stated, the deaths of 37,287 people from cholera, or, more properly, from the existence of local insanitary conditions, which ought long since to have disappeared under efficient sanitary rule.

15. *Small-pox.*—The periodical character of small-pox epidemics in Bombay is well shown by the following table of mortality:—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1874	3,903	1880	940
1875	3,461	1881	539
1876	11,817	1882	1,630
1877	27,369	1883	13,404
1878	4,475	1884	14,438
1879	1,156	1885	2,646
Total	52,181	Total	33,597

The lower mortality of 1885 appears to mark the subsidence of an epidemic, and a comparison of the sums of these two periods shows a decided falling off in the death-rates during the last six years, due in all probability to improved and extended vaccination, but it should be remarked that the epidemic character of the disease still exists.

16. The death-rate in 1885 was the same for town and country districts, namely, ·16 per 1,000. Twenty-two per cent. of the deaths took place in infants under one year of age.

All the registration districts returned small-pox deaths except Surat (it had only one death) and Broach, which also had one death.

Out of 283 registration circles, small-pox deaths were returned from 176, but the whole mortality took place in 887 population groups out of 40,897. Twenty-four towns out of 62 yielded 334 deaths.

17. The deaths, month by month, were as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - - -	353	July - - - - -	112
February - - - -	383	August - - - -	86
March - - - -	500	September - - - -	36
April - - - -	421	October - - - -	33
May - - - -	341	November - - - -	44
June - - -	274	December - - - -	53

The figures appear to show that the small-pox deaths of 1885 were part of the epidemic of 1883–84 in its decline.

18. *Vaccination service.*—The following list gives the total strength of the vaccination service for the official year 1885–86, which, be it remarked, ought never to be used in any statistical work bearing on the public health. The calendar year is the only statistical year.

Deputy Sanitary Commissioners - - - -	5
Superintendents of vaccination - - - -	3
Inspectors of sanitation and vaccination - - -	31
Assistant superintendents of vaccination - - -	5
Clerks and karkuns - - - - -	29
Vaccinators - - - - - -	501
Peons - - - - - - -	520
Total staff - - - -	1,094

The vaccinations reported as successfully performed by this staff in the official year were 818,135.

Of the total vaccinations (including 294,426 in Native States), which numbered 854,387, 95·76 per cent. were successful. Of the successful vaccinations, 363,519 were performed on infants under one year of age, and 151,424 between the ages of one and six.

But the registered births of the year were 572,431, and of these 100,609 died within the year, leaving 471,822 as available for vaccination, so that in round numbers about three fourths of the children born were vaccinated during the first year.

A reference to the tables in the Report shows that, in the last 10 years, no fewer than above seven millions of persons have been vaccinated in Bombay Presidency, and that 78,414 persons had died of small-pox during the same period. In the 10 years, moreover, there had been two epidemics, each having a maximum of two years' duration, and that of the total 10 years' mortality, 67,028 were incurred during the four epidemic years.

19. There has been very good vaccination work done, and no doubt much useful life has been saved, but the facts show clearly enough that something besides vaccination is required to cope with small-pox, and this is simply the abatement or removal of the epidemic local conditions, without the presence of which, so far as we know, no disease would show itself in the epidemic character.

20. *Fevers.*—Diseases classed under this head gave rise to 163,561 deaths of males and 150,676 deaths of females, a total of 314,237 persons. On account of uncertain diagnosis the classification cannot be accepted as accurate, but whatever may be the nature of these "fevers," they do not, in Bombay at least, show the same tendency to become epidemic as they do in other parts of India. This character is shown in the following 12 years' abstract:—

Years.	Deaths from Fever.	Years.	Deaths from Fever.
1874 - - -	183,717	1880 - - -	246,779
1875 - - -	219,156	1881 - - -	272,403
1876 - - -	220,833	1882 - - -	243,454
1877 - - -	336,865	1883 - - -	266,741
1878 - - -	357,376	1884 - - -	276,989
1879 - - -	286,526	1885 - - -	314,237
Total - -	1,604,473	Total - -	1,620,603

In the first column of this table are shown two years of increase in fever mortality due to the famine and scarcity in 1877–78. Otherwise there has been a fair annual average of fever deaths until 1885, which shows a marked increase. The table supports the inference that fever mortality is on the increase.

21. All the registration circles returned deaths under this head in 1885, and out of 40,894 villages 28,246 suffered. Fever deaths were also registered in all the towns. The district fever death-rate was 19·74 per 1,000, and the town rate was 14·83, while the rate for the entire Presidency was 19·10 per 1,000.

The fever rate of any given year may be said to include elements which are constant, such as the general sanitary state of the people, of which the fever death-rate is an important index, and other elements which are variable, such as the food-supply and atmospheric conditions.

The following monthly table of fever mortality shows the probable influence of the last of these elements:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - -	23,497	July - - -	26,767
February - -	21,697	August - -	30,171
March - - -	23,350	September - -	29,346
April - - -	22,062	October - -	32,027
May - - -	23,229	November - -	29,904
June - - -	23,751	December - -	28,236

The table assigns a considerable increase of mortality to the hot, moist, and drying-up seasons.

22. Registered fever deaths were much more numerous in some districts than in others. In Ratnagiri, for example, the fever death-rate was 8·28, and in Bombay city 8·38 per 1,000, while in Nasik it was 25·83, and in Broach 32·35 per 1,000. There was a general increase in the fever rates in all the districts, while the Presidency rate, which had been 15·92 per 1,000 on a five years' average, had risen to 19·10 in 1885. But, as has been already stated, the fever-rate may safely be assumed as showing what is the sanitary state of villages, towns, houses, and their surroundings, subject, of course, to accidental increases from extraneous causes. The facts as they stand afford additional proof, if any such were necessary, of the unfavourable local conditions under which the population is placed.

23. *Bowel complaints.*—There were 45,056 deaths registered from bowel complaints in 1885, the largest number since and before the famine year 1877, in which year 60,257 people died of diarrhœa and dysentery chiefly. These diseases were universally prevalent, for deaths from them were returned from all the registration circles, with only six exceptions, and a fifth part of the villages suffered. The seasonal prevalence of bowel complaint mortality was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - -	3,035	July - - -	4,580
February - -	2,788	August - -	5,377
March - - -	2,831	September - -	4,840
April - - -	2,761	October - -	4,734
May - - -	3,132	November - -	3,945
June - - -	3,695	December - -	3,332

The death-rate for the year was 2·73 per 1,000, against a previous five years' average of 1·88. Belgaum and Dharwar districts yielded the highest death-rates of the year, namely, 6·09 and 6·41 per 1,000. The death-rate for the country population was 2·78 per 1,000, and for the towns 2·42 per 1,000. The preceding abstract shows that the mortality was greatest during the second half of the year, but there was no real synchronism in the data with those of other epidemics. Some of the towns yielded very high bowel complaint death-rates. For example, the rate for Pandharpur was 13·90 per 1,000; that for Athni was 13·77 per 1,000; and Jambasar, out of a population of 11,479, had 332 deaths from these diseases, or 28·92 per 1,000. There are not sufficient data in the Report to enable us to trace the etiology of "bowel complaints," but their usual causes are bad water and filth. Bad or deficient food are also well known aggravating causes, but taking the facts as they stand we may safely assume that the usual local causes of epidemic diseases bore their part among death causes.

24. *Injuries.*—There were 5,577 deaths assigned to injuries to injuries in 1885, or 0·34 per 1,000 of the population. Of these deaths 2,427 were due to drowning, 182 to poisoning, 236 to hanging, 502 to wounding, 110 to wild beasts, 1,100 to snake-bite, and 1,040 to other causes. The five months June to October include the times of greatest loss of life from snake-bite.

25. *All other causes.*—Under this head are placed 68,788 deaths, or 4·18 per 1,000 of the population, in regard to which nothing beyond the numbers is known.

26. *Sanitary Works* (*Military*).—The total amount spent for military sanitary improvements was Rs. 1,63,233, chiefly in improvements which, so far as we can estimate their intention, would be of use in abating certain minor disease causes. The money was spent chiefly in improving latrines, wells, finishing a hospital, surface drains, &c. None of them require detailed notice, as they mostly belong to the class of current repairs.

27. *Sanitary Works* (*Civil*).—The income of all the municipalities in Bombay Presidency amounted to Rs. 30,70,624, or in round numbers 300,000*l.*, of which 68,000*l.* was spent on conservancy. A list of towns is given in which various sums have been spent on sanitary improvements, chiefly in water-supply, drainage by surface drains, latrines, and the like, but not much appears to have been done in these directions, except in surface drainage of main streets and roads in municipal towns by masonry channels. Cesspools are still in use, and the water-supply generally is the same as in former years. Not much real progress in lowering the death-rates has yet been made. The rates from all death causes, which had been 28·27 per 1,000 on a previous five years' average, had risen to 31·47 per 1,000 in 1885. Both rates are much too high for towns under efficient sanitary managements.

28. In the local fund circles, which include the country population, small sums were spent here and there in improving and constructing wells, chiefly, but if we apply the statistical test the result well be found to be equally unsatisfactory, for the five years' country death-rate, which had averaged 22·17 per 1,000, had risen in 1885 to 28·41 per 1,000. It is impossible to assert that these figures show any signs of sanitary improvement, or that they show that past methods of dealing with sanitary defects in this Presidency have been effectual in protecting the public health. No doubt the figures are not altogether reliable, but the deaths registered are not likely to exceed the actual casualties, and these show that real sanitary work has yet to be initiated in both towns and villages.

29. There are some remarks on this subject in Section X. (Personal Proceedings and General Remarks) which may be noticed. In visiting Surat, the Sanitary Commissioner endeavoured to impress on the Municipal Commissioners the need of improving their town and getting rid of the cesspit wells with which it is "riddled." He advised that application should be made to Government for a consulting engineer, but they replied that they could not pay for his services. This ancient city has a population of 109,844, and its death-rate in 1885 was 30·95 per 1,000, with a previous five years' average rate of 29·27 per 1,000. The authorities at Broach, while admitting the bad state of the town, pleaded poverty as an excuse for doing nothing.

30. There is one satisfactory statement, at least so far as it goes, about the villages. Government had had this matter before them, and they had called for reports from Commissioners and Collectors on the subject. The Sanitary Commissioner had also drawn up a memorandum on the insanitary state of villages, and how to deal with these local problems, and Government had issued a resolution setting forth the principles on which a draft Bill is to be prepared to ensure the adoption of more efficient measures of village sanitation. This, it is to be hoped, is the first step towards providing Bombay with something like a sanitary executive, and without this nothing can be done in the way of improvement. It has been for so many years the practice in India to collect and publish unfavourable public health statistics and descriptions of local disease causes, that up to the present time it has scarcely been recognized that all such work is of no practical value by itself. Its only use is to lead up to sanitary improvement, and this cannot even be initiated without a local executive. No doubt, as the Sanitary Commissioner states, sanitary work must at times interfere with local prejudices, but it has always done so, and everywhere. Knowledge, experience, perseverence, and judgment are all needed in this work, but in the end it is sure to effect its object.

31. Under this same section the Sanitary Commissioner informs us that in the course of the year there had been three separate outbreaks of cholera in Poona, while the city death-rate has risen from a five years' annual average of 23·57 to 37·04 per 1,000.

Increasing unhealthiness of this city is partly attributed to rise in the subsoil water level from canal irrigation without drainage to such an extent that the subsoil water level had risen flush with the soil, and the ground had become so rotten that sugar-cane would not grow on it. In such cases there appears also to be no executive to prevent injury, such as the French Government has in Algeria for dealing with similar cases.

32. The question of hospital accommodation for cholera cases is again discussed with reference to the contagion hypothesis. We have in former Memoranda said all that was necessary about it, and we need only repeat that the one consideration to be kept in view is to do what is safest and best for the patient, who cannot be removed to a distant hospital without danger to life. There is, in fact, no other interest requiring attention.

33. An important step has been taken by the Government of India in directing that future bills of health for outgoing ships shall certify that the ship is "in a satisfactory condition, and that no case "of infectious disease dangerous to life exists among its officers, passengers, or crew." This bill necessitates the inspection by the Officer of Health of the ship itself, and if any disease breaks out on the voyage it will enable the authorities of the port of arrival to place the blame on the proper parties, who, as will be seen, will not be the outward port authorities, but the captain or owners of the vessel. It is an important step towards solving all disputed questions about quarantine.

The following abstract shows the number of outward-bound vessels and their destination for the year 1885 :—

Ports to which sailed.	Number of Ships.	Crews.	Passengers.
Europe *vid* Canal	454	24,024	6,703
Aden and Eastern Coast of Africa	16	1,190	409
Red Sea Ports	40	2,875	160
Suez	7	511	—
Port Said	17	473	9
Mauritius	13	444	694
Persian Gulf	71	4,562	6,020
Total	618	34,079	13,995

This table shows that 618 vessels, with 48,074 persons on board, left Bombay in good sanitary condition. The port authorities had discharged their duty to Bombay and to the ports towards which these ships were bound, and if cholera appeared on board any of them, it is clear that the commerce of Bombay ought not to bear the blame and suffer.

Besides these ships there were inspected 232 Native craft bound for the Persian Gulf and other foreign ports. They had 6,674 of crews and passengers on board, all in good sanitary condition. One very important part of the work done has been to ensure that ships' bilges were kept sweet, and, in reference to this point, it may be stated that during the examination of vessels directed by the General Board of Health in 1849 there was one firm of shipowners whose ships were reported to be always healthy, and to last longer with fewer repairs than other ships. On being applied to for information, the owners stated that their only secret consisted in having a fresh sea-water tap in the captain's cabin, by means of which fresh sea-water was allowed at stated times to pass into the bilge while the pumps were worked on deck.

Of pilgrim ships 52 were inspected, whose crews were 769 in number, and the passengers 8,436. The only disease among them was a case of leprosy, which was landed.

These data show that in 1885 the Health Officer inspected 862 ships and other vessels with 63,953 persons on board, all, with a solitary exception, in health. One ship was refused a bill of health because the captain gave no opportunity for inspection. But as regards the others the Health Officer states that he had received every assistance from the shipping agents and masters in carrying out the sanitary inspection of vessels, and that, with the exception of pilgrim ships, all were found to be in a fairly good sanitary condition. No doubt before long the pilgrim ships will be improved under inspection. Any way a good commencement has been made.

34. The number of arrivals in the port of Bombay is not stated, but in the course of the year six ships were found to have infectious cases on board. The particulars were as follow:—

Port whence sailed.	Diseases.
Mangalore	1 case chicken-pox.
Port Said	1 small-pox, convalescent.
Colombo	1 ditto, ditto.
Bhaonagar	1 small-pox.
Zanzibar	1 ditto.
Troopship "Jumna," Europe	9 cases measles.

There were 15 entries of pilgrim ships, but the full particulars are not stated. The mortality on board was very great, and appears to call for some inquiry. There were 5,045 pilgrims on board. Seven of the ships had escaped disease, but from on board the other eight there were 103 cases of sickness admitted to hospital, of which 57 proved fatal. As so much stress has been laid on pilgrim ships in quarantine discussions, it may be suggested whether more details regarding these death causes, and the means taken to prevent their occurrence, might not be obtained and published.

35. As regards the port of Bombay, it has been undergoing considerable improvement in some respects, but much more effectual steps must yet be taken to root out its purely local disease causes, as may be judged of by the fact that in 1885 there were 39 cases of cholera and 33 deaths among the harbour population of 24,887 persons, and four fatal cases took place on board Her Majesty's ship "Briton," lying in the harbour. The vessel went to sea and escaped further losses.

36. In conclusion, while admitting the important advances which are being made in these matters affecting the health and commerce of the port of Bombay, we are bound to state that, so far as regards the civil population of the Presidency, the statistics show clearly enough that past methods of dealing with local causes have been without material influence on the public health. The statement includes not only the health of the village populations, but also the health of towns having local executive bodies.

The town of Ahmedabad may be considered an extreme instance of the results of sanitary neglect or indifference, but as the Sanitary Commissioner has cited it, we may quote his result. The population of this town averages 120,461. It has a municipal commission exercising, or at least supposed to be exercising, sanitary powers, while its 11 years' average death-rate has been 53·15 per 1,000, and its high death-rates are known to be related to the use of cesspits, want of drainage, and doubtful

water-supply. Now experience such as this points to the absolute necessity of interference with the strong hand, either to compel the authorities to do their duty or to do it for them.

As regards the villages, if there be any executive in them, it is clearly in abeyance, and so of no utility. Surely it is time to put an end to all this, and to provide not only the means of executing perfectly well known sanitary works and measures, but of seeing by skilled technical oversight that they are carried out.

The Sanitary Commissioner's Report for 1885 only adds the witness of another year's experience to the need of a total change not only in the point of view from which sanitary problems ought to be regarded, but in the administrative methods of dealing with them.

4th February 1887.

No. 4.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bengal for 1885.

The population of Bengal under registration in 1885 consisted of—

Males	32,832,216
Females	33,331,668
Total	66,163,884

2. Arranged according to classes, there were of—

Christians	101,884
Hindus	42,953,029
Mahomedans	21,361,957
Budhists	79,721
Other classes	1,667,293
Total	66,163,884

3. The distribution of this vast population between town and country circles will show very clearly the localities where sanitary work is most urgently required. This stood as follows :—

Urban circles, population	2,277,055
Rural „ „	63,886,829

The urban circles include 133 municipalities and unions having authorities spending money on sanitary work of more or less importance. In the rural circles little has as yet been done. We shall afterwards discuss briefly the year's work in both classes of circles, but our present object is to report here what we have stated year after year, that the most important sanitary problems in Bengal, as in other Indian Governments, are those connected with the population of villages, of which there are 231,705, while the towns properly so called number 94 only.

4. *Registration of births* is still limited to a population of 1,664,577, inhabiting 46 towns. This has been done partly on account of existing difficulties in the way of including the whole population under any practicable method of arriving at the facts, and partly in the expectation of obtaining an approximate birth-rate which might be applied within limits to the whole population. The result in 1885 was that, excluding still-born, there were registered in these towns 39,640 births, yielding a birth-rate of 24·71 per 1,000, manifestly under the truth. But, like all averages, this one includes extremes, such as 40·41 and 53·23 per 1,000 in two of the towns, and 7·94 and 8·18 at the other end of the scale.

5. Registration of deaths extends to all the 647 circles of registration in Bengal, including the towns. Excluding the calculated still-born, 1,504,745 persons died of disease in 1885, yielding a death-rate of 22·74 per 1,000, against a previous five years' mean rate of 18·59 per 1,000, but part of this large apparent increase has no doubt been due to the better registration. None of the rates, however, show the real ratio of mortality.

Divided between the town and country populations, the ratio for the 94 towns was 31·63, against a previous five years' average of 28·64 per 1,000, and for the country the death-rate as registered was 22·42 per 1,000, and the previous five years' rate was 18·20 per 1,000.

The death registration appears to differ in efficiency in different towns and districts, as we have seen to be the case with that of births. There are a number of town rates of 20 per 1,000 and under, and a number with double that amount or more. Gya, for example, returns a rate of 52·35, Barrh of 56·50, and Sitamurrhi of 58·12 per 1,000. The district rates show similar extremes. There are ratios of 14 to 15 per 1,000, and there are others of double that amount.

6. The data, as a whole, can only be accepted as showing the present state of the registration, and roughly the year's losses by death. In other words, the questions raised by the data are registration questions perfectly well known and fully discussed by the Sanitary Commissioner, who has at the

same time called attention to improved methods of arriving at the real facts, which appear to promise better results for the future. Accepting the data as they stand, it happens unfortunately that, when compared with the data of former years, these hold out no proof or promise that the public health of Bengal is undergoing any material change for the better, if indeed they do not point in an opposite direction.

7. This appears all that is necessary to say on the subject of registration, and we shall next proceed to discuss the year's disease history. The following abstract shows the chief death causes for the year 1885 :—

Death Causes.	Registered Deaths.	Deaths per 1,000 of Population.
Cholera	173,767	2·62
Small-pox	9,863	·14
Fever	1,042,142	15·75
Bowel complaints	63,808	·96
Injuries	28,956	·43
All other causes	186,209	2·81
All causes	1,504,745	22·74

Out of the total year's mortality, 1,289,580 deaths, or 85 per cent., were due to diseases of the epidemic class, and hence another year's experience proves that what the public health service has to concern itself with in India is the mitigation or prevention of epidemics, or rather the absolute and immediate removal of those local conditions which, by their destructive influence on health, predispose the people to epidemic attacks.

It is one consequence of neglecting this duty that the local predisposing causes of epidemics have a tendency to increase in intensity, subject of course to the local influence of climate, food supply, and variable conditions, and hence the longer they are neglected the more difficult are they to remove.

8. The following abstract of a table given by the Sanitary Commissioner shows apparently the reaction of continued insanitary conditions on the amount of epidemic disease in Bengal for a series of years :—

Death Causes.	Death-rates per 1,000.		
	1880 to 1884.	1884.	1885.
Cholera	1·59	2·03	2·62
Small-pox	·26	·28	·14
Fevers	13·42	14·60	15·75
Bowel complaints	·83	·88	·96
Injuries	·34	·37	·43
Other causes	2·13	2·66	2·81
All causes	18·59	20·83	22·74

These figures show improved registration, but they also show progressive increase in the fatality of epidemic diseases. Any way we have the fact for 1885 that, out of a registered death-rate from all causes of 22·74 per 1,000, no less than 19·47 per 1,000, or 85 per cent., were due to mitigable or preventible epidemics.

9. We shall next give the epidemic mortality in town and country from the same table which contains the preceding data.

Death Causes.	Ratios per 1,000 of Population.					
	1880 to 1884.		1884.		1885.	
	Urban.	Rural.	Urban.	Rural.	Urban.	Rural.
Cholera	3·32	1·52	3·81	1·96	5·22	2·53
Small-pox	·55	·25	1·10	·24	·33	·14
Fevers	15·17	13·35	12·89	14·66	14·40	15·79
Bowel complaints	3·67	·72	3·24	·79	4·12	·85
Injuries	0·42	·34	·44	·36	·50	·43
Other causes	5·90	1·98	5·91	2·54	7·02	2·66
All causes	29·05	18·19	27·43	20·58	31·63	22·42

If the death statistics were reliable, this extract would show increasing mortality from cholera in the towns where there is some sanitary work in hand, and also in the country where there is little or none. A similar result has apparently occurred with the allied diseases classed as bowel complaints. Fever mortality has diminished in the towns, but it has increased in the country districts. In the case of small-pox the differences are not so marked; but the figures also show improving registration, so that while the recorded death rates may admit of being compared, the actual deaths are obviously understated in the record. The rates for the town circles are nevertheless nearer the true rates than are the country rates. Whichever view may be taken, there can be little doubt that of late years no improvement in the public health as regards these diseases can be claimed either for town or country.

10. We shall next introduce a few remarks on each of the death causes in the table, beginning with the annual deaths from cholera for a period of 10 years, including the year under review.

Years.	Deaths.	Deaths per 1,000.	Years.	Deaths.	Deaths per 1,000.
1876	196,590	2·97	1881	79,180	1·19
1877	155,305	2·34	1882	182,352	2·75
1878	95,192	1·43	1883	90,439	1·36
1879	136,363	2·06	1884	134,421	2·03
1880	39,643	·59	1885	173,767	2·62

During the second five years in this abstract, the cholera deaths exceeded those in the first five by upwards of 37,000. It is quite safe, therefore, to conclude that no effectual measures have been taken to mitigate or remove those local predisposing causes which tell so severely on the fatality of cholera. Indeed the mortality of 1885 was the third in order of amount during the 10 years. The five years' mean mortality from cholera was 1·59 per 1,000, and, as we have seen, the death-rate in 1885 had risen to 2·62 per 1,000.

11. All the districts in Bengal were attacked in that year, and out of 647 circles of registration only 13 returned no cholera deaths. The villages which suffered numbered 22,239 out of a total of 231,705 in the province.

12. The next abstract shows the deaths from cholera registered month by month, together with the corresponding rainfall.

Months.	Deaths from Cholera, 1885.	Rainfall in 1885.
		Inches.
January	8,067	·21
February	6,880	1·26
March	12,396	·84
April	19,926	1·55
May	20,473	4·18
June	13,000	11·85
July	12,347	14·70
August	22,675	17·81
September	19,213	13·45
October	14,392	2·92
November	12,404	·53
December	11,995	·94

There is a relation shown in this table between the cumulative rainfall and decline of cholera, but it is not so marked as it has been in other years. This may probably be due to the fact that the average rainfall does not necessarily represent the fall in specific localities.

13. It has been already shown that the death-rates in town and country districts were 5·22 and 2·53 respectively, but, as usually happens, these averages included extremes. The lowest district rate was that of Darjiling, 0·20 per 1,000, and the highest was that of Birbhum, 6·77 per 1,000. In this instance, out of a population of 786,580, no fewer than 5,327 died of cholera. High as this death-rate is for a cholera epidemic, it is a small matter when compared with the rates of some of the towns, where sanitary work is supposed to be in some sense done.

Darjiling town is the only town which escaped cholera, and the other 93 towns all suffered more or less, some of them to an excessive degree. A few of them may be enumerated in which the death-rate exceeded 10 per 1,000.

—	Deaths per 1,000.	—	Deaths per 1,000.
Kalna	11·55	Jamalpore	19·61
Ranigunge	12·16	English Bazaar	10·13
Soori	17·45	Deoghur	11·11
Nobodip	10·40	Poori	28·76
Sitamurhi	27·91	Hazaribagh	11·23

The only remark called for by facts such as these is that there can be no real sanitary work done where such rates are of possible occurrence.

14. We shall next give a brief abstract of the information obtained by the Sanitary Commissioner regarding the local conditions which accompanied outbreaks of cholera in 1885. There is nothing new in the facts, for they have been reproduced year after year. The Sanitary Commissioner has given due weight to them in his Report, but unfortunately there appears to be as yet no means of dealing effectually with them.

15. *Kalna* town, in Burdwan, had a cholera death-rate of 11·55 per 1,000, "attributed to its "objectionable conservancy arrangements, the existence of well privies being the chief evil."

16. It has happened in this country that persons engaged in coal mining have suffered severely from cholera, due to neglect of very ordinary sanitary precautions, and partly to overcrowding. A similar experience has presented itself in villages where the mines of the Bengal and Equitable Coal Companies are situated, "associated with pilgrims and in some cases with bad drinking "water."

17. In certain attacked thanas in *Bankura*, the insanitary conditions are, it is said, the worst "imaginable. They are ill drained, with marshy land, and cesspools with accumulations of filth and "low jungle abound. The habits of the people are very filthy, and heaping of cow-dung near "houses is the rule."

18. The town of *Soori*, in Birbhum, had a cholera death-rate of 17·45 per 1,000. Out of 7,848 inhabitants, 137 died of cholera. "It was noticed that whenever the disease appeared it "confined itself to a few houses; that while the central part of the town formed the area of "visitation, the outskirts, the people of which had no occasion to go to the town for their water-"supply, but derived it from independent sources, were entirely free from it; and that the jail, "situated close to the affected localities, also enjoyed complete immunity from it." The Sanitary Commissioner remarks on this case that "nothing can illustrate better the sanitary condition of a "place than the severity of cholera during an epidemic visitation. Had the Soori town been in "a good sanitary state, which it is not, no such heavy mortality would have occurred in it." In this district there was a "water famine" from drought, and the people had to supply themselves from roadside puddles.

19. In *Midnapur* district cholera was attributed to great want of good drinking water, and it is stated by the Civil Surgeon that on every occasion when he visited cholera-stricken localities he found that his orders to close foul tanks in their vicinity against use was followed by a complete subsidence of the disease.

20. In *Hughli* district cholera was prevalent in eight towns and thanas, including Serampore town, which had a death-rate of 3·01 per 1,000. In previous Reports the need of a better water-supply had been proved, and a proposal had been made for affording a generally better supply of filtered water for the riparian towns, but, as if to show that irresponsible local self-government is no more to be depended on in health questions than was the case formerly in England, a large majority of the Municipal Commissioners of Serampore rejected the proposal "as an unnecessary expense." There appears to be a want of some authority to order them to do their duty, or to do it for them and charge them with the cost.

21. 24-*Pergunnahs*.—In this district Naihatti town lost 207 of its people from cholera out of a population of 21,533, or 9·61 per 1,000. This high rate "was contributed to a great extent "by an outbreak of disease which occurred in the villages near the Gouripore mills," attributed to water from a foul tank. "The cooly huts are, moreover, ill-constructed, limited in accommodation, "and have no ventilation, and their floors are almost on a level with the ground."

22. The *Suburbs of Calcutta*, which yielded their customary high cholera-rate of 7·46 per 1,000, were visited by the Sanitary Commissioner who found "very few of the many suggestions" which he had made attended to; but by way of finding a cause for the cholera in Entally ward, it is stated that the Chairman of the Municipality assigns it to Calcutta drainage operations. It is to be hoped that before any great lapse of time the suburbs will be incorporated with the Calcutta municipality, and this assumed causation finally disposed of.

23. *Kishnaghur* town, in Nuddea, had a cholera death-rate of 4·36 per 1,000 out of 27,477 people, and its condition is described as follows. It is "a very large straggling town which, it is said, is "being gradually depopulated by the prevalence of sickness in it. It is badly sanitated, abounds "in rank jungle and filthy swamps, has no proper drainage, and contains innumerable cesspits and "accumulations of rubbish. The water-supply from three or four tanks is extremely bad and "saturated with impurities." A number of wells were sunk at the time of the outbreak.

24. *Dacca*.—"The high mortality in the Dacca town is again referred to the non-extension "of filtered water to the whole of it, necessitating the use by the greater portion of its population "of impure water, one or more filthy wells existing in every compound. I should add to this cause "the highly insanitary conditions which yet obtain in this town."

25. *Backergunge*.—The north side of Barisal town in this district, which suffered from cholera, is reputed to have been in "a very bad sanitary condition," mostly covered with jungle, with deep pits,

several containing stagnant water, in which night-soil is thrown by the municipal mehters. "The "stench from these pits was sickening." In the same district *Jhalokati* town had nearly one half of its year's mortality caused by cholera. Its sanitary condition "is the worst in the district."

26. *Chittagong.*—The past insanitary history of this town has been long known. It has a population of 22,130, out of which 140, or 6·32 per 1,000, died of cholera in 1885, and the Sanitary Commissioner says, "that notwithstanding the monetary assistance given by Government the "Commissioners appear to be in a chronic state of inability to effect much good in it." Some motive power appears to be needed in this instance as in so many other similar cases of Indian municipalities.

27. In a district of *Purneah* into which cholera was "supposed" to have been imported, the Deputy Sanitary Commissioner "found most of the villages visited by him to be, in a sanitary point "of view, worse than an average busti, with filthy surroundings consisting of middens, of accumu- "lations of decomposing cattle ordure, and refuse of pits full of stagnant water, of ground saturated "with the liquid excreta of cattle and human beings and of house refuse. Water oozing through "the fences and making the pathways filthy, or soaking into the ground within house enclosures." This simple statement of facts shows how peculiar are these village sanitary problems, and that they differ materially from those presented by large cities. In fact, they require a separate study and a separate executive method in dealing with them.

28. *Durbhanga.*—In this district the jail escaped cholera, while the town of Durbhanga, of 66,096 inhabitants, registered 550 deaths, or 8·32 per 1,000 of the population. In this town the Civil Surgeon observes that "the spread of cholera is in proportion to the insanitary condition "of the infected area, and the magistrate, agreeing with him, furnishes the following lamentable "account of the villages in Durbhanga. He says that these villages are in marked contrast with "the majority of those in Eastern or Central Bengal. In the Durbhanga villages one meets "constantly with the most disgusting and revolting sights, and is always overpowered with the "most abominable smells. The sides and centres of the roads are strewn with human ordure. "It would appear that all classes without exception had by common consent agreed to use the main "street as the principal latrine of the village, the consequence being that night and day a deadly "faecal odour pervades the whole atmosphere, and it is a fearful ordeal in the morning to thread "one's way in safety through the uncleanness and filth, with the village pigs brushing against the "legs in their haste to devour the noisome repast. He believes that the entire soil of the villages "must be saturated with the filth of ages."

29. In cases such as these the alternative at once suggests itself of selecting new sites for such villages, placing the sites in good sanitary state, laying down an authoritative code of village sanitary law, with means of execution and inspection, and then removing the village by degrees. The vacated sites would have some value as manured land.

30. The case of *Chupra* town, in Sarun, is cited by the Sanitary Commissioner as affording "a vivid illustration of the evils of neglected sanitation." It had a death-rate from cholera of 6·96 per 1,000, or 371 deaths out of a population of 53,249. "The efforts," he says, "made to "check the disease cost much money, which, instead of being spent in this emergency, could have "been much better employed in carrying out permanent sanitary improvements, and thus guarding "the town from the visitation of the disease. It requires 16 gangs of coolies of 12 men each to "clean out the drains, and 50 chowkidars, each paid at two annas a day, to guard the water-supply." This town has a large conservancy establishment. "But the Commissioners get very little work for "their money." This case is an instructive one, because it includes within it some important points of experience in sanitary administration. Spasmodic efforts to check epidemics when they are in a place may result in aggravating the losses of life by disturbing filth which it may be safer to leave alone until the disease has passed away. It is one of the specialities of sanitary work that it is essentially preventive of disease, but not curative. When an epidemic attacks an unhealthy town or village, the filth, or bad drainage, or bad water have already done their work. So that the extra outlay incurred in the vain endeavour to keep out the disease when it is already there is simple waste. Again, as the facts show, it is not enough to employ and pay so many sweepers and other people, simply because sanitary work must be done on some well-defined plan suitable to the population, and this cannot be done without organization and intelligent oversight. In this case also, while the town suffered, the jail escaped cholera.

31. The Sanitary Commissioner further discusses an important question in the sanitary improvement of this town, namely, the nature of the sanitary works required to remedy the evils. On this subject there are a variety of views apparently. But the practical result is that the matter is a purely technical one, which could only be effectually dealt with by an officer thoroughly acquainted with town sanitary work. Such a case in England would soon be dealt with by an engineering officer of the Local Government Board, who would easily be able to decide what it was best, most practicable, and most economical to do. But surely it is time that India should be provided with skilled technical aid of this kind.

32. It may be noted in reference to *Motihari* town, in Champuran, where cultivators bring their opium to be weighed, that when cholera is about there is danger from the crowding and from neglect of suitable sanitary provisions. These defects, we are glad to see, have been dealt with by the Sanitary Commissioner.

33. The death-rate from cholera in *Cuttack* district was 5·77 per 1,000. This was partly due to a cyclonic storm, leading to "exposure and hardship from want of shelter, want of, or consumption "of bad food—the food stores having been destroyed or damaged, and bad water, which was "generally contaminated by the dead bodies of human beings and animals, by fallen trees, and other "sources of impurity, and on the sea-coast by the tanks and wells having been filled with salt water." Defective sanitary precautions also entered into the chain of causes.

34. *Poori* district has a population of 863,703, and registered 4,606 deaths from cholera, or 5·33 per 1,000, and Poori town, with a population of 24,784, had 713 cholera deaths, or 28·76 per 1,000. Similar facts are of seasonal occurrence, and when considered simply by themselves, and in reference to the seasonal influx of pilgrims and nothing else, they would apparently stand in the relation of effects to causes, and this appears to be the view of the Civil Surgeon. We may admit the facts, and yet doubt the causation supposed, as the Sanitary Commissioner does. There is, however, no difficulty in the matter, for this Poori experience is only part of what has been often observed elsewhere. For example, it is known that moving bodies of people affected with cholera can carry the disease with them, in greater or less apparent intensity. It is further known that much of the fatal disease along pilgrim routes is not cholera at all. Next, it is matter of experience that if affected bodies of people enter unhealthy, foul, crowded towns and villages during cholera seasons, where cholera outbreaks are always more or less imminent, the disease will increase among pilgrims, and may be set up in the town or village, not because of its introduction, but because the disease is already in the district, while the added filth and crowding supplies the spark to light up the epidemic; and the reply on the whole question from the practical side is, that neither in India nor anywhere else ought there to be any cholera to move along with a moving body of people, nor any local causes in town, villages, or halting places to endanger the public health. We are glad to learn that the Civil Surgeon does his best to deal with the sanitary wants of Poori. The facts show, however, that much in the way of improvement is needed in the town, and one thing is certain, that no quarantine in such cases would be either practicable or useful.

The great pilgrim centres and pilgrim routes require special treatment, because their circumstances are special. Besides the ordinary epidemic localizing causes which are at present in force everywhere, the shrines are liable to periodic crowdings, with increase of filth, bad water, bad food, and similar condictons, and the amount of cholera will very much depend on the seasonal intensity of the epidemic. Similar remarks are applicable to other assemblages, as for example the great crowds at the coal mines in Hazaribagh district, which we are glad to see have been dealt with by the Sanitary Commissioner at the request of the Government.

35. *Port of Calcutta.*—The population of the Port of Calcutta appears to suffer from the same epidemic conditions as the city itself does, but not to the same extent from local insanitary conditions. This is shown by the following death-rates from cholera in 1885 :—

	Deaths from Cholera.	Deaths per 1,000 of Population.
Port of Calcutta - -	67	2·3
Town of „ - - -	1,541	3·8
Suburbs of „ - - -	1,936	7·69
Howrah municipality - -	325	3·57

36. This brief abstract of the cholera history of 1885, given by the Sanitary Commissioner, shows what are the local causes with which an Indian sanitary executive will have to deal, but, as will be presently shown, there are other epidemic and endemic diseases whose unremoved localising causes lead to greater losses of life and prosperity than accrue from cholera epidemics, but before dealing with these we shall notice the year's experience of cholera at fairs, which in some respects differs from that of previous years.

37. Out of the large number of fairs held in Bengal there were outbreaks of cholera at 17, including the Poori pilgrimage, which yielded 277 deaths, and another pilgrimage at Murshidabad, at which 125 deaths took place. In three instances the number of deaths is not given, but in two of these there were only four cases. Excluding the pilgrimage cases there were 132 deaths, but if the pilgrim deaths be included these would have been in all 534 deaths. The numbers present are not given for all the fairs, but at 13 of them the attendance was estimated at 446,210. It is stated that at Poori and Murshidabad sanitary precautions were adopted, but the results show conclusively that these were insufficient, or not adapted to the pilgrimage conditions at the time. In the Murshidabad case it is indeed stated that sanitary precautions were taken "after the outbreak." At five fairs no precautions were adopted. Another case in which no precautions were taken until after the outbreak was the Chooramani fair held in the 24-Pergunnahs, at which there were 50 deaths before the pilgrims dispersed. One other element in liability to cholera is mentioned by the Sanitary Commissioner, namely, the epidemic intensity, and he says, "It was, however, naturally to be "expected that in a year when the disease was so diffusely spread over the province public "gatherings could not escape." This is, of course, true, but the question suggests itself whether the current cholera history does not furnish indications sufficient to enable warnings against assemblages o be given in time to diminish or prevent them, and so to save life.

38. There is no difficulty in understanding the fairs question, especially when cholera is extensively prevalent. There are crowds of people in detachments becoming concentrated on certain points, and as these people, by the supposition, have passed or are passing through cholera districts, and so are all more or less predisposed by the prevailing epidemic conditions as well as by the circumstances of their journeys, it is clear, as we have already shown in reference to pilgrimages, that the mere concentration at the fair or centre may be quite sufficient to lead to an outbreak of cholera, while the risk would be increased by unremoved sanitary defects. The key to the whole question is that the best remedy in such outbreaks is simply to disperse the people, and it follows that the best means of prevention is to spread the people over large areas at the places of fairs or pilgrimages, besides adopting all requisite local sanitary precautions. In the Poori outbreak the remedy adopted was preventing crowding in lodging-houses and additional conservancy arrangements. But surface agglomeration, even if both these measures were taken, would still be left. Any way, in the Poori case 277 people out of 70,000 present died of cholera, or nearly four out of every 1,000, and our object in noticing it specially is not to find fault with what was done, but to raise a question which has been discussed more than once in India, namely, the whole question of management of these assemblages, besides the local measures in preparation for them.

39. *Small-pox.*—The following table, from data given by the Sanitary Commissioner, includes the small-pox mortality in the province for a period of 10 years :—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1876	10,746	1881	24,371
1877	8,088	1882	13,651
1878	12,410	1883	9,714
1879	22,843	1884	18,533
1880	22,953	1885	9,863

The small-pox death-rate in 1885 was 0·14 per 1,000, and the previous five years' mean was 0·26 This disease has been marked by irregular periods of epidemic increase, and although there is a slight falling off in the mortality in the second column in this table (908 deaths) it would scarcely be safe to assume this reduction as marking the influence of vaccination. It seems rather to be an incident in epidemic history.

40. In 1885 small-pox deaths were registered in 376 out of 647 circles of registration, and in 5,615 villages out of 231,705 in the province. The attacked points were comparatively few in number, and they were not equally scattered over the area. The district death-rates varied as usual. In some the rates scarcely admitted of tabulation on account of their minuteness, and in only one instance, Champarum, did the rate reach 1 per 1,000 (1·19). The mean death-rate for the towns was 0·33 per 1,000, and for the districts it was 0·14 per 1,000.

41. The mortality was highest in the hot months, as shown in this monthly abstract :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	741	July	747
February	1,148	August	354
March	1,734	September	180
April	1,771	October	99
May	1,547	November	86
June	1,224	December	232

Taken according to age, the small-pox deaths under 12 years of age stood as follows :—

—	Deaths.
Under 1 year	2,217
1 to 6 years	3,851
6 to 12 „	1,346
	7,414

Or 75·17 per cent. of the total small-pox mortality.

42. *Vaccination.*—The vaccination staff for the official year 1885–86 was made up as follows :—

Superintendents	8
Deputy superintendents	11
Native inspectors	86
Head vaccinators	22
Vaccinators	461
Apprentices	51
Licensed vaccinators	1,177
Total vaccination staff	1,816

A new feature in the service was the employment of two female vaccinators, one in Calcutta for visiting and vaccinating in the zenanas, but without much immediate result; the other had been a female medical student in midwifery, and had given every satisfaction in her vaccination work.

43. The total vaccinations performed in the official year 1885–86 amounted to 1,361,781, of which 1,345,257 were reported successful. The total vaccinations successfully performed in all the circles of superintendence, according to age, were the following, out of a population of 49,299,987 :—

Under 1 year - - - -	199,424
1 and under 6 - - - -	891,129
Above 6 years - - - -	177,626
	1,268,172

Besides primary operations, there were 2,129 successful re-vaccinations. These figures show a large preponderance of vaccination work at the younger ages, but for ages under one year, at which vaccination affords most protection, the work done fell below the necessities. There are no means as yet of arriving at the real births for Bengal, but taking 30 per 1,000 as a moderate estimate, this would represent the births as 1,478,980 within the vaccination circles, a number which may be compared with the vaccinations under one year of age. The facts require no comment, but their teaching clearly is that vaccination requires to be specially directed towards the younger ages.

44. But in its epidemic form, small-pox, like all other epidemics, may be expected to decrease in virulence as really effective sanitary improvement is advanced, but not otherwise.

45. *Fevers.*—The following 10 years' abstract of deaths classed as "fevers" shows how comparatively unimportant are epidemics of cholera and small-pox to the public health of Bengal :—

Years.	Fever Deaths.	Years.	Fever Deaths.
1876 - - -	561,537	1881 - - - -	940,911
1877 - - - -	711,036	1882 - - - -	929,943
1878 - - - -	742,887	1883 - - - -	913,766
1879 - - -	622,260	1884 - - -	966,233
1880 - - - -	689,605	1885 - - - -	1,042,142
5 years - -	3,327,325	5 years - -	4,792,995

This table includes in a few lines the public health problem of India. It is not correct in detail, because of the undefined nature of the diseases classed as "fevers," but for practical purposes, febrile disease and its mortality, whatever may be the nature of the fever, is a sure test of the insanitary conditions under which the people live, and the preceding table shows that fever deaths are greatly and rapidly on the increase, and that from some cause or causes, the health standard of the people is declining.

46. In 1885 all the circles of registration returned deaths from fever. It is probable that every population group in Bengal suffered more or less from non-fatal cases; but some idea of the extensive prevalence of the disease may be formed from the fact that deaths were registered in 147,675 villages out of 231,706 in the province, while the cholera mortality, as already has been stated, was reported from 29,239 villages, and that from small-pox from 5,615 of them.

47. The population of country districts numbers 63,866,829, and of these there died 1,009,333, or 15·79 per 1,000, from "fevers," while in the 94 towns, every one of which suffered, there were 32,809 deaths, or 14·40 per 1,000 reported.

48. As usually happens, the fever death-rates, both of districts and towns, varied considerably. In seven districts the reported fever deaths were under 10 per 1,000, and in 11 they exceeded 20 per 1,000, with a maximum rate of 27·81 per 1,000 in Nuddea, which is a marked and well known hotbed of fever. In the towns the fever death-rates were mostly between 10 and 20 per 1,000, but in some cases they were much higher. One town, Purneah, with a population of 15,016, lost 481 of its inhabitants from this cause, or 32·03 per 1,000.

49. The following table, prepared by the Sanitary Commissioner, shows the relation of fever to rainfall :—

Months.	Deaths in 1885.	Rainfall, 1885.	Average Deaths in 1880–84.
		Inches.	
January	79,404	·21	77,905
February	70,041	1·26	62,546
March	80,208	·84	63,484
April	75,777	1·55	65,341
May	71,618	4·18	60,991
June	64,506	11·85	54,278
July	67,269	14·70	50,454
August	86,499	17·81	67,214
September	99,323	13·45	71,432
October	110,929	2·92	86,976
November	c125,467	·53	109,216
December	111,101	·94	109,254

In the entire group of years there is a marked increase of fever deaths in the last quarter, and this quarter, if we can assume the rainfall as proportionately constant for the same years, shows the full influence of cumulative rainfall in the preceding months, together with the influence of drying up and of colder and more variable temperatures.

50. We have no control over these atmospheric causes, but it ought to be borne in mind that they act through local conditions on the public health, and that it is with these last that sanitary work has to concern itself. What the rainfall really does is to bring out with fatal result the effect of local conditions which, under a complete public health executive, ought either to have no existence, or to be so dealt with as to reduce their influence to a minimum. But there are cases mentioned in which local fevers were apparently diminished in severity by floods which covered the country, thereby renewing the water supply and ensuring movement in the subsoil water. Topographical fever causes are tolerably well known; but, as part of the year's history, we shall abstract some observations on the subject from the present Report.

51. In Bankura district there has been less fever of late, but two circles, Kotalpur and Bissenpur, have suffered considerably. On this subject the Assistant Surgeon says, that "the whole district "may now fairly be considered as thoroughly included within the endemic area of malarious fever. ". . . . All the villages in the district outside Bankura town present a marked similarity in "their insanitary conditions; flat, low-lying, badly drained places, with a stiff soil extremely retentive "of moisture, and decomposing marshes form the peculiar feature of the places. . . . . In the "town of Bankura, where the natural drainage is excellent, so that stagnant pools of water are "scarcely seen, and the ground moisture is at its lowest from the extreme porosity of the soil, there "is scarcely any malaria worth the name, and malarious cachexy is unknown, while in the district, "even in places at a distance of a few miles from the town, fever prevails to an unusual extent, and "malarious cachexy is strongly marked."

52. Fever in the southern part of Panchura thana, in Midnapore, is attributed by the civil surgeon to inundation, bad drainage, and decomposition of vegetation.

53. In Hughli district obstructed channels were to be restored so as to substitute running streams for chains of water pools.

Fever mortality has diminished in Nuddea district, but the report contains no proof that this event has been due to drainage works. It is probably only a periodical diminution.

54. Rungpore town had a fever death-rate of 31·08 per 1,000, and all the thánas in the same district have suffered severely. The civil surgeon accounts for the fever by the topographical conditions of the country, which is formed with undrained depressions, giving rise to stagnant pools, jungle, rotting vegetation, and general water-logging. Nevertheless, the country is naturally rich, and admits of great agricultural improvement, although something has been already done in this direction. The soil is so fertile that it requires neither manure nor irrigation, and yet there is decay. Here we have the elements of agricultural prosperity side by side with excessive loss of life from fever, which also means lower general health and diminished working power among the population, and hence poverty instead of plenty. It is clear that in such cases where entire communities, and not single villages, are liable to suffer, that the State should do its part in the removal of disease causes which affect the district as a whole. There is, in fact, no other remedy.

55. The civil surgeon attributes the prevalence of fever in Maldah "to retention of rain-water "in the numerous bhils and silted-up river beds with no outlets."

56. In Shahabad, fever prevailed very extensively, and the death-rate was high. In Bazaar thana it was 30·97 per 1,000. "The Assistant Surgeon of Sasseram reported that there was not a single "village in which the disease was not present, while in the town of Sasseram all the inmates of every "house were affected." He attributes its prevalence to subsoil humidity caused by increased rainfall and to canal irrigation. The joint magistrate states "that it is an ascertained fact that the level of

"the subsoil water has risen throughout the canal irrigated tracts, and that the canal embankments "cause much obstruction to the drainage of the country."

57. We have frequently called attention to the great danger to health and life caused by the execution of these one-sided improvements. Their object is, of course, beneficial, and is to provide food; but the result to the general prosperity of the country is, to say the least of it, doubtful, if the working stamina of the people to be fed is so reduced by the canals that they die of fever, and the survivors are rendered less fit for work by the measures taken to increase the food supply. What is wanted in the execution of such works is thorough knowledge of their relations to health, and with this knowledge there would be no difficulty in obtaining the advantages without the risks.

58. These illustrative facts will show the nature of fever causes, natural and induced, with which a sanitary executive in Bengal would have to deal. It will have been seen that they are all related to the general drainages of the country, but they include by no means the whole of the fever causes from which the people suffer. They only show the prevalence of water-logged subsoil, but in previous reports the Sanitary Commissioner has also shown how this state of the subsoil involves the state of villages and village houses.

Given a water-logged district, build clay houses on it sometimes scarcely raised above the ground level, having no drainage of villages and no adequate domestic cleanliness, keep cattle in the houses and compounds, let the people have impure water to drink, and we have adequate causes for all the fevers which decimate and impoverish Bengal; but we have at the same time all the elements with which a sanitary executive would be glad to deal and remove, so that, making every allowance for the undeniable difficulties of the case, the only question is whether the work is one which comes within the sphere of Government in India, as it has certainly been considered to come under the Government of England. This is distinctly recognised by the provisions of the Public Health Acts.

59. *Bowel Complaints.*—The deaths from bowel complaints amounted to 63,808 in the year under review, against 58,376 deaths in 1884.

The death-rate in 1885 was 0·96 per 1,000. In the preceding year it was 0·88 per 1,000, and the five years' mean rate was 0·83 per 1,000. It follows that in this, as in all the diseases of the epidemic and endemic class, there was a notable increase of deaths in 1885.

60. The bowel complaint death-rate in the districts was 0·85, and in the towns 4·12 per 1,000, the mean for the whole population having been as already stated 0·96 per 1,000. All the districts and towns returned deaths from this cause, and all the registration circles, with 20 exceptions, did so likewise.

61. These statistical facts show that deaths were returned from nearly the entire area of Bengal, but the attacks were strictly local, as the deaths were all returned from 24,778 villages out of 231,705, or from about a tenth part of the number. As usually happens with endemic diseases, bowel complaint mortality was much greater in some localities than in others. The district death-rates were returned between 0·12 and 5·04 per 1,000, while the town ratios lay between 0·44 and 10·24.

62. The following table, showing the monthly mortality, confirms the view that these diseases were endemic in character rather than epidemic :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	5,009	July	4,857
February	4,240	August	6,247
March	4,764	September	6,413
April	4,946	October	6,081
May	4,908	November	5,900
June	4,607	December	5,809

The table bears marks of a slight seasonal increase, but any predisposing causes must be sought in the attacked towns and villages.

63. These causes it may be safely taken for granted belong to the usual category, but there is one occurrence mentioned by the magistrate of Chittagong as in all probability showing the effect of a special cause. "An epidemic of dysentery and diarrhœa occurred among the coolies in the Futick-"cherry tea estate. During this outbreak 25 died from an average strength of 588 labourers. It "was attributed to bad water from the Barromassi river, which had been dammed up by the coolies, "owing to there being no wells in the garden, but the dam having been burst soon after by a flood "the water became muddy and filthy. The employers of the coolies have been requested to sink "wells." Water such as this is stated to have been is a very likely predisposing cause of fatal bowel diseases. It has indeed been long known that predisposition to dysentery has been arrested by substituting pure water for foul.

64. *Injuries.*—During 1885 there were 28,956 deaths returned under this head, or 0·43 per 1,000 of the population. The assigned causes were as follows:

Suicides—	
Males	1,040
Females	1,783
Wounds	1,627
Accidents	13,325
Snake-bites and wild beasts	11,181
	28,956

Part of the large death-rate from "accidents" is attributed to drowning during a cyclone.

65. *Other causes* not specified in the returns yielded 186,209 deaths.

66. *Port of Calcutta.*—In a preceding paragraph we have shown the relation of cholera in the port to the Bengal epidemics of 1885, and we shall conclude this abstract of the year's disease history of Bengal with the facts relating to the port population under all the heads of disease classification. In 1885 there were 23,573 European seamen entered at the port. The deaths among these from cholera were 7 out of 16 cases admitted to hospital. The Sanitary Commissioner, estimating the average port population at 1,693; states the cholera death-rate at 4·13 per 1,000. With reference to the question of the health of this port, the following abstract will show that great improvement in this respect, among European seamen at least, has been effected within the last year or two:—

Years.	Admission to Hospital.	Deaths per 1,000 of Population.
1880	23	10·0
1881	51	24·4
1882	64	22·8
1883	65	19·8
1884	67	21·3
1885	16	4·13

As the method of calculating the population has been the same we may accept the figures for the purposes of comparison, but they cannot be assumed as showing the true death-rates. The fact would rather appear to be that, out of 23,573 seamen who arrived in port in 1885, only 16 were attacked by cholera and only 7 died, or 0·29 per 1,000.

Among the Native floating population, 25,409 in number, there were 59 deaths from cholera, or 2·32 per 1,000. This death-rate exhibits a reduction similar to that among European seamen.

Among European seamen the incidence and mortality from fever stood as follows in 1885, out of 23,573 arrivals:—

——	Admissions.	Deaths.
Enteric fever	4	1
Malarious fever	194	2
Simple	244	—

The fever death-rate would thus be only 0·27 on the arrivals.

Among the Native floating population there were 12 deaths from malarious fever, or 0·41 per 1,000.

Among European seamen there were the following casualties from bowel complaints:—

Dysentery - - - - 116 cases, 6 deaths.
Diarrhœa - - - - 102 „

The death-rate on the arrivals was 0·25 per 1,000.

Among the Native floating population there were four deaths from dysentery, or 0·15 per 1,000.

Nine European seamen were drowned in the course of the year.

There is obviously much improvement required in the sanitation of the port of Calcutta, but, so far as can be learned from the facts, substantial advance in this direction is being made.

67. *Sanitary works, (Civil).*—The expenditure on sanitary works is given in the Report for 133 municipalities and unions situated within 44 districts of Bengal. A few other municipalities had been added in the course of the year, but their amounts had not then been rendered. Their total income, including balances from the preceding year, was Rs. 30,41,223. 9. 8, in round numbers 304,122*l.* Of this amount 56·88 per cent. was spent on sanitary works, including roads, or excluding roads, 40·29 per cent. The total income fell short of that of 1884 by 23,710*l.* The amounts spent varied considerably in different municipalities, but the following abstract of expenditure under the

usual heads will show generally the extent and nature of public health work done by all of them during the year under review :—

	Rs.
Conservancy including latrines	3,80,714
Conservancy establishment	2,91,828
Drainage	52,363
Water-supply	1,57,366
Disposal of dead	7,544
Markets and slaughter-houses	24,451
Vaccination	15,417
Treatment of sick	2,08,078
Other sanitary works	87,503
Total	12,25,264

The amount spent on roads was Rs. 5,04,811. The amount spent on strictly preventive sanitary work, including vaccination, was Rs. 10,17,186, or, in round numbers, 101,718*l.* There was an increase of sanitary expenditure of 3,463*l.* on certain items, and a decrease of 752*l.* on others. The increase included 2,218*l.* for water-supply, and the decrease 1,857*l.* for conservancy and 5,261*l.* for drainage. Practically, there was a reduction of 7,118*l.* in expenditure on the most essential sanitary works of conservancy and drainage.

68. But the amount expended for original public health purposes is no adequate measure either of the necessities or of the way in which these have been met. For example, a list of 96 municipalities is given, in 54 of which there was no expenditure on drainage; in 70 there was no outlay for water-supply; in 67 none on conservancy, and in only 6 cases was any outlay incurred on disposal of the dead, and in only 4 was provision made for markets and slaughter-houses. The total year's outlay under each head stood as follows :—

	Rs.
Drainage	16,533
Water-supply	53,118
Conservancy	15,862
Disposal of dead	1,781
Markets and slaughter-houses	6,816
	Rs. 94,110

Taking for granted that current sanitary work was more or less effectively carried out, this outlay of 9,411*l.* marks, as the Sanitary Commissioner states, the "actual progress made in sanitation" in the towns," when compared with the gross outlay already given.

69. Full details of the sanitary work done in towns and districts are appended to the Report, but they are all of small extent, and not likely to produce any marked impression on susceptibility of epidemics. The most important works of the year were the outlay of 3,998*l.* in completing the waterworks of Burdwan. "The filtered water continues to confer immense benefit on the townspeople." The local medical practitioners are of opinion that "it has diminished the sickness and mortality of the town." This appears to be a case in which the question may not unfairly be asked whether Burdwan, with such a water-supply, and on the cholera water theory, ought to have escaped cholera. Whatever the reply may be, it would make no difference as regards the great importance of pure water to the public health. We have seen what the medical profession has to say on this subject as regards Burdwan, but when we turn to the statistics we find that, out of its population of 34,080, there were 213 deaths from cholera, or 6·25 per 1,000. Unless it can be shown that these 213 fatal cases had not used the pure filtered water, we appear to be forced to the conclusion in this instance that the cholera deaths were due to some other cause than cholera polluted water. We need only state further that this Burdwan case is simply one example in addition to a great number of similar instances, and it shows that, when every household in the town has been provided with pure water, it will not necessarily be exempted from cholera. The sanitary works and measures required for this object obviously lie outside the water-supply.

70. Howrah has not yet got in its water-supply. But the Civil Surgeon says that "every Commissioner is anxious for pure water, and will exert himself to get it as soon as he knows, 1st, what "it will cost to have a sufficiently ample supply; 2nd, how the money is to be raised for the work; "and, 3rd, how the rate is to be levied for it in a town where the ratepayers most highly assessed "will be those least able to make use of the supply. He has not seen a practical answer to these "questions."

Now these questions include a large part of the practical sanitary engineering problem for India; they include engineering questions of drainage and other matters as well as water-supply: and they can be answered in one way alone, if the object is to obtain efficient work at the least cost, and that is by calling in the aid of an experienced sanitary engineering department to apply its principles and experience to each case as it arises. This was really the advice of the Royal Commission of 1859, and it has been the practice of the General Board of Health and its successors at home, and if

this advice had been followed such questions would have probably long since have ceased to require answer for India.

71. In many other cases works of water-supply and drainage have been under consideration, but the difficulty has been the usual one of want of funds. Nevertheless, if the work detail be merely considered by itself, we might agree with the view of the Sanitary Commissioner, who says:—"Taking a general review of the progress made in sanitation as above detailed, I trust it will be "allowed that a large amount of good and useful sanitary work was accomplished this year." Such as it is, the work has been done mainly in towns. But there is no evidence that villages have as yet received much benefit from it. The real test, however, of sanitary improvement is supplied by the death statistics, and as these may be considered as more carefully kept in the towns than in the country circles, it may be allowable to ask what evidence they afford of improvement in the public health. The answer unfortunately must be, none at all. On the contrary, the average town death-rate on a five years' period was 28·64 per 1,000, while in 1885 the rate had increased to 31·63 per 1,000. The registered country death-rate had likewise risen from a five years' average of 18·20 to 22·42 in 1885. This latter comparison cannot be accepted as accurate. But for the towns, it is clear that, whatever amount of work detail may have been carried out, its nature was not such as to mitigate the local death causes.

72. *Personal proceedings. Port of Calcutta.*—Sanitary questions connected with the port have a special bearing on the commercial interests of Calcutta, because outbreaks of epidemic diseases on board ships at sea are, to a large extent, dependent on the sanitary state of the locality where the vessels have been moored. On this subject there is a fact stated which is of grave importance to sanitary administration all over India. It appears that a large amount of night-soil and foul water is floated into the river from a khal, into which the filth is thrown by the suburban municipal authorities, and the result of complaints made on the subject is thus stated by the Medical Officer:—"Repre-"sentations to municipal bodies are almost useless, the difficulty of controlling their conservancy "establishment being apparently beyond their power." If this experience were in any degree of common occurrence it would clearly show that these bodies are incompetent to perform the duties which have been placed on them.

Another important matter is mentioned, namely, the method of supplying water to the shipping, which, it appears, exposes the water even after filtration to be fouled in its transit. The Port Officer very properly proposes that proper tank boats should be provided.

In the course of the year the Health Officer inspected 780 inward bound vessels, with 55,879 of European and Native crews on board, and 626 outward bound ships, with 25,466 seamen on board. The Native Port Inspector inspected 9,989 boats, of which 238 were found in a foul condition. The inspecting work appears to have been carefully done.

73. Among "Personal proceedings" the results are given generally of the inspection of 27 municipalities. In some cases good work appears to have been done and considerable activity manifested by the authorities, but in other cases there has been neglect and consequent retrogression, and the suburbs of Calcutta, with several other towns, are described as in "the worst possible condition."

74. In the course of the year six Deputy Sanitary Commissioners and eight Deputy Superintendents of Vaccination inspected 5,206 villages, and the general results of their work are thus summed up by the Sanitary Commissioner:—

"The following defects are common to a more or less extent in all the villages which were visited with very few exceptions:—

"*Dwellings* badly constructed, ill arranged, crowded together, and devoid of ventilation.

"*Roads* narrow and unmetalled, chiefly consisting of tortuous byepaths, and unprovided with side drains.

"*Pits, hollows, and other excavations* common, and allowed to become receptacles of every description of festering filth or of stagnant water.

"*Conservancy* conspicuous by absence, defæcation and micturition being performed everywhere. Human and cattle *excreta*, and all kinds of house and other refuse, being accumulated and allowed to fester near houses.

"*Water-supply* for drinking and domestic purposes taken from any source, no matter how polluted or fouled.

"*Drainage* mostly absent, or, if existing, defective and obstructed.

"And all these are the result of the apathy or indifference displayed by the people to the simplest elements of sanitation, and who, moreover, fail to recognise any wrong in conditions which have descended to them from their ancestors."

75. This summary is quite sufficient by itself, and without quoting the Deputy Inspector's reports, to show what are the prevailing disease causes in these Bengal villages, and the initial obstacles to all improvement presented by the long continued filthy habits of the people. On the other hand one of the Deputy Sanitary Commissioners does not consider the habits of the people filthy, but curiously enough, he says that certain of the worst of them are "racial." This, of course, is merely another way of saying that bad habits are apt to become fixed, and it is with these very habits that the sanitarian has everywhere to deal, or there would be no need of him.

The most important fact of the whole is, that such a condition of the population of Bengal should be capable of description above twenty years after the Royal Commission on the sanitary state of the

Indian Army had shown how this state of matters might possibly have been dealt with and amended. The facts are not new, but the difficulties of dealing with them are increased by every year's neglect. The fault does not lie in want of knowledge, for nobody could have been more faithful in exposing the facts than the present Sanitary Commissioner and his predecessors. Indeed, the present Report may take rank among the most important yet drawn up by the present Indian Sanitary Service.

The evil lies not at their door, but it arises and is continued, by want of an executive.

It is impossible to read the Sanitary Commissioner's summary already given, and on arriving at the last clause of it, without seeing that, unless some more effectual method be adopted for overcoming apathy and substituting active and efficient work for it, the Bengal Sanitary problem is hopeless.

This is the practical result of Dr. Lidderdale's Report. He has shown distinctly and fully the great losses due to preventible epidemics, and their nature, and what is now required is some efficient and skilled sanitary executive, not alone to pass sanitary laws, but to see that these obvious and removable disease causes are dealt with on long known and proved principles of procedure, not only in towns, but in villages.

25th February 1887.

No. 5.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Punjab for 1885.

1. In this Report, as in all the other provincial Reports, the assumed population is that of 1881, which was returned at 17,512,378.

2. In 1885 there were born 390,799 males and 341,135 females, yielding a birth-rate of 38·84 per 1,000 for both sexes, which together numbered 731,934. It is evident that much excellent registration work was done in the course of the year, although the machinery by which the facts are ascertained admits of improvement. In some districts the birth-rate is below the truth, and in others there is reason to suspect that from errors in transmission probably more births were registered than actually took place. But there is every prospect that errors of this kind will diminish in time.

3. The registered deaths in 1885 numbered 507,140, or 27 per 1,000 of the population. Of these deaths 143,787 were infants under one year of age, and 97,938 between the ages of 1 and 5, so that the deaths under five years were 241,720, or 47·6 per cent. of the total mortality.

4. The following have been the approximate annual death-rates in the Punjab for 18 years :—

Years.	Death-rates per 1,000 of Population.	Years.	Death-rates per 1,000 of Population.
1868	15	1877	20
1869	26	1878	36
1870	24	1879	38
1871	21	1880	27
1872	25	1881	30
1873	20	1882	27
1874	18	1883	25
1875	25	1884	35
1876	28	1885	27

It will be observed that in the later years of this table the death-rates have risen, and that in some years the augmentation has been irregular, pointing apparently to improving registration, but also to periodical increase of epidemic mortality. From what is known of Indian registration we should scarcely be justified in assuming that the registered death-rates show absolute increase of mortality, but it cannot be said that these rates show improved health.

5. As usually happens the rates varied greatly in different districts. A few yielded death-rates under 20 per 1,000; most of them lay between 20 and 30 per 1,000. The highest rates of the year were, Gurgaon, 41, and Rohtak, 42 per 1,000. But these high rates were exceeded by the 5 per cent. death-rate of Delhi district.

6. We shall next discuss the disease history of 1885 under the usual classification :—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	1,936	0·10
Small-pox	7,575	0·40
Fevers	346,763	18·40
Bowel complaints	17,711	0·94
Injuries	5,551	0·29
Other causes	127,604	6·77
All causes	507,140	26·90

The deaths in this table show that 73 per cent. of the mortality of 1885 was attributable to diseases of the epidemic and endemic class, affording sure evidence that the public health is by no means in a satisfactory or safe condition, and the immense losses assigned to "fevers" suggest anew that great advantage to public health work would arise if we could obtain more definite information as to the real nature and causes of deaths so classed.

7. Following the order in this table we shall first discuss the facts regarding cholera. This disease was not universally diffused over the Punjab in 1885, for out of 31 districts 10 escaped the epidemic. There was none in Peshawur division, and there were only three deaths in Jullundur division. Out of 441 circles of registration only 86 returned deaths, and the entire mortality of the year fell upon 219 villages out of 35,338. The year's mortality would, however, average nine deaths per attacked village, a proportion which shows considerable local severity of the epidemic, although the disease appears to have shaded off towards the North-West, at least in its epidemic form, because the death-rate, which in the North-West Provinces and Oudh was 1·44 per 1,000, fell off in the Punjab to 0·10 per 1,000, or less than a fourteenth part of its fatality.

8. Cholera epidemics in the Punjab have in times past presented considerable annual variations in severity, as is shown by the registered deaths in the following abstract for the last 19 years:—

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1867	43,146	1877	29
1868	532	1878	215
1869	9,258	1879	26,125
1870	469	1880	274
1871	269	1881	5,207
1872	8,727	1882	39
1873	148	1883	190
1874	79	1884	614
1875	6,246	1885	1,936
1876	5,738		

The years of greatest mortality were the two great Hurdwar pilgrimage years, 1867 and 1879, but it must not be forgotten that these were severe epidemic years in other extensive areas of India, although the crowding of so many thousands of pilgrims into populated localities during an epidemic was very likely to have increased the number of deaths locally. The epidemic law shown in the preceding table is that of sudden increase followed by as sudden a diminution of mortality. But if the two Hurdwar pilgrimage years be left out of the history, the remaining data in the table would appear to show that of late the severity of cholera has lessened in the Punjab. There have been indeed individual years during which it was perhaps the least fatal disease in the country.

9. The next abstract shows the cholera mortality month by month. One presumed death in January, afterwards ascertained to have been from fever, has been left out.

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	—	July	323
February	—	August	177
March	—	September	206
April	78	October	63
May	193	November	464
June	268	December	163

These monthly data point to an endemic rather than to an epidemic character in the cholera of 1885. The comparative mildness of the disease appears to have afforded an opportunity of tracing the history of first cases. But, in referring to these, it must be stated that there is no information about the Hurdwar pilgrimage, to which some of them are attributed in the Report. It appears to have been an ordinary annual assemblage.

10. A solitary death on a camping ground in Umballa district in the week ending 18th April was in a man who "had come straight from Hurdwar." Five town deaths in Umballa were in people who had come from Hurdwar.

The first case in Delhi was in a man from Kashmir," "but it was found that he had personal "communication with the pilgrims on his way back." No information as to the nature and amount of communication or as to the health of pilgrims is given. The causation is a mere opinion.

The second and third cases in Delhi were in men who had not been out of the city.

A solitary case in Karnal is stated to have been that of a man "who had recently returned from Hurdwar." The information is too limited to found any opinion on it.

During the week ending 25th April, there were 24 fatal cases of cholera in Amritsar city, and as the facts appear to have been carefully observed, they merit more detailed notice. It appears that on the 16th March a letter was received at Amritsar, requesting that an extra inspecting staff should be appointed for the trains arriving at Amritsar, and, on the 19th, five pilgrims from Saharanpur were removed from the train dead or moribund. Next day, nine dead or moribund pilgrims arrived.

Another pilgrim was attacked outside the city. The next case was in a man, not a pilgrim, who had arrived four days before from Delhi. He is said to have bought cooked food near the railway station. On the 22nd April four fresh cases were found among Hurdwar pilgrims, and a fifth case took place in an open thoroughfare in Amritsar. No connection could be discovered between this case and the pilgrims, except that the patient's shop was in the bazaar through which pilgrims passed. A man who served in the shop had a smart choleraic attack at the same time. Next day there were eight cases within the city not connected with each other. There were five cases on the 24th, of which one took place in a lady in cantonments whose husband was employed within the city.

11. The following details from the Lahore report bring us nearer the essential facts of the case: "The Hurdwar fair closed on the 11th April, and pilgrims began to arrive at Lahore about "20th April. On account of the difficulty the railway authorities had in organizing transport for "the crowd of passengers, a block occurred at Saharunpur, where camps of pilgrims had to be formed, "in which cholera prevailed. . . . The first cholera case at Lahore was that of a pilgrim who "had started from Hurdwar on the 16th, reached the city on the 19th, and on the 20th was found "in a state of collapse. He finally recovered . . . . . The first eight cases were all of Hurdwar "pilgrims, except a Pathan who had come from Delhi." The Sultan serai where the pilgrims resorted was in a disgraceful state. The succeeding four cases were in residents in Lahore, two of them in the compound of the hospital, but neither in attendance on cholera cases.

12. The most detailed importation case is said to have occurred in a small village of Dhilwán, in the Faridkote State, on 23rd April, but the presumed facts were only inquired into on 4th May. They are thus stated by the Civil Surgeon. The village "is situated three miles east of the Kot-"Kapura station on the Rewari and Ferozepore Railway, in the Faridkote territory. Two brothers "arrived by the morning train of the 23rd April from Hurdwar." (Hurdwar fair ceased on the 11th.) "One of them was ill with cholera. He recovered, but his companion, who had washed the "sick man's soiled clothes at the village well, or rather at one of the two wells, was seized with "cholera, and died. A sweeper who took water from the well trough at the time the clothes were "being washed also took cholera. This was on the 24th April. No other case occurred until two "days after. On the 27th, the disease began, and between that date and the 2nd May 70 deaths "are said to have taken place." The Civil Surgeon's conclusion from the Native accounts, such as they are, is that "the outbreak is clearly shown to have been caused by the contamination of water "by cholera discharges." Without discussing what is called the cholera water hypothesis, it is permissible to point out that there were two wells, only one of which is presumed but by no means proved to have been contaminated, and it is not shown that this contaminated water only was used by all the persons attacked. Had this fundamental fact been established, we should then have been in a position to pursue the inquiry further.

13. The presumed proof of relation of the cholera of 1885 with Hurdwar is wanting in necessary particulars already referred to, namely, the facts regarding Hurdwar itself, of which no account is given in any report. Then there is no proof that the cases carried by railway from the camp at Saharanpur (and it is certain that there were many such cases) had any causative relation to cholera cases elsewhere, because there are many similar instances given in the Report in which cholera appeared without pilgrims.

14. A few notes on the sanitary condition of cholera affected localities are given in the district abstracts, and these clearly show that, with the presence of cholera in the country, there were sufficient local causes in many affected places to account for the disease outbreaks. One of these cases may be mentioned on account of its resemblance to an occurrence which took place at the Plague Hospital in Malta during the cholera epidemic of 1865. It relates to a severe local outbreak of cholera at Firozpur, and is thus stated by the Deputy Commissioner. The disease appeared on the 9th, and lasted until the 30th June, and between these dates there were 400 cases and 189 deaths. "During its prevalence in Firozpur the *locale* of the disease was very clearly marked. The cases "were almost entirely confined to a very confined part of the town, dominated by a high wall which "shuts in the air very much. The first sanitary precaution appears to be that this wall should be "partly pulled down, and its height, especially on the western side, reduced from about 30 to 10 or "12 feet. This matter I am taking up." But, besides the wall, "there is a large manure heap "outside the town, where the ordure has been collected for some time. The smell from this even "now, after rain and wind, for days is very bad, quite enough, one would think, to account for "anything in the way of disease."

Several interesting cases are given in proof of the purely local character of this outbreak. These arrange themselves under two heads, where persons entering affected locality returned to their own unaffected villages, took cholera, and died without spread of the disease, and cases where persons entering the towns from unaffected localities died there of cholera, while no cases took place in the villages from whence they came.

15. As regards the stagnation of air produced by high walls, and its deadly influence on cholera, the proposition is generally admitted, but it is always useful to obtain examples. In the Malta case cholera broke out with great violence in a perfectly isolated series of buildings, formerly used as a plague hospital, and which happened to be occupied at the time by soldiers' families, who had no communication with any source of cholera. There was evidence, however, of choleraic disease among them, in the form of diarrhœa, before the outburst came. The buildings, in conformity with the old plague theory, were closely enclosed by high walls, which effectually shut out ventilation,

They had closed drains, without water, and there was great nuisance from them, pervading all the rooms at the time. The families were removed, but it was found necessary to lower the walls to allow of perflation of air before further occupation. It is easy to understand how a local disease cause, involving air impurity, may be less mortal in its action if the atmosphere is in motion, than it would become if air movement were artificially prevented, as it was in the Malta case, and as it appears to have been in this Firozpur outbreak. The experience shows that, in dealing with local disease causes, all the facts require careful discussion, in order that the proposed remedies may adequately meet them. It has, indeed, happened in India that a wall has been built to keep out a nuisance instead of removing its cause.

16. The practical result of another year's experience of cholera in the Punjab appears to be that, whether an epidemic be intense or not in its activity, the localizing causes are essentially the same, that they are always active, and that the losses of life are determined by the epidemic force at the time.

17. But there is another matter to which it appears necessary to call attention, and this is the transport of cholera cases along the railway lines between affected and unaffected districts of country. As we have shown, in our Memorandum on the Assam Report, that by the application of ordinary sanitary precautions the amount of cholera among tea garden coolies in the course of voyages up the Brahmaputra has been greatly reduced, while care is taken not to ship cases in which cholera is threatened, it may be suggested whether a special inspection of Native railway passengers might not take place, at all events during fairs and festivals, that doubtful cases may be kept back, and so avoid the deplorable results described in this Report of dead bodies or moribund passengers having to be removed from the trains. It ought not to be a difficult matter to remedy this defect. This remark is, of course, made in the absence of knowledge of existing practice, and has been suggested solely by the facts as stated in the Report.

18. *Small-pox.*—The following table shows the annual registered deaths from small-pox for a series of 18 years :—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1868	23,759	1874	12,026	1880	9,145
1869	58,195	1875	18,611	1881	6,749
1870	27,163	1876	10,254	1882	6,379
1871	25,834	1877	12,296	1883	12,103
1872	23,738	1878	40,271	1884	16,416
1873	25,699	1879	49,489	1885	7,575
Periods of six years	184,388	-	137,937	-	58,367

The data in this table show a large reduction in small-pox deaths during the last 12 years, but they also show the tendency to recurring seasons of great epidemic severity, while the two most fatal years, 1878–79, include the last great Hurdwar fair of 1879, to which the severe cholera epidemic of the same year was attributed. During the same pilgrimage year the fever deaths attained a maximum number of 472,939. The year was, in fact, one of very severe epidemic prevalence over a large area of India, and over the Hurdwar district among others.

19. Small-pox deaths numbered 7,575 in 1885, or 0·40 per 1,000, against a preceding five years' average of 0·55 per 1,000. Of these deaths 2,224 took place at ages under one year, and 4,708 between the ages of one and 12 years, so that six-sevenths of the mortality fell on the younger ages. The country districts yielded 6,727 deaths, or 0·38 per 1,000, and the towns 883 deaths, or 0·63 per 1,000. Twenty-eight towns out of 49 registered small-pox deaths, and of these Lahore returned the high rate of 4·79 per 1,000, but a very much smaller proportion of villages suffered, for all the deaths were returned from 2,379 of them out of a total number of 35,338.

20. The monthly prevalence of the disease stood as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	570	July	743
February	402	August	398
March	530	September	253
April	625	October	255
May	850	November	664
June	739	December	1,576

The great increase of mortality in December was mainly due to outbursts of the disease in Amritsar, Lahore, Shahpur, and Peshawar districts, which contributed 886 deaths to the year's mortality.

21. There is no account of the vaccination work of the year, but we believe that this has been better organised of late years.

Except the high death-rate in Lahore city, there is nothing calling for further remark.

22. *Fevers.*—The following 18 years' abstract table shows how greatly more important to the public health of the Punjab are diseases classed under this head than any or than all others:—

Years.	Fever Deaths.	Years.	Fever Deaths.
1868	151,337	1877	219,281
1869	272,956	1878	440,492
1870	275,093	1879	472,939
1871	213,548	1880	327,727
1872	264,711	1881	355,279
1873	219,909	1882	346,680
1874	190,631	1883	306,164
1875	279,825	1884	465,556
1876	351,286	1885	346,763

We must make allowance for improvements in registration in the course of these 18 years, otherwise we should be forced to conclude that fever mortality in this province had seriously increased. Again, the annual deaths, if even approximately ascertained, would show that there is considerable variation in the annual fever-rates, and it becomes an important matter to ascertain to what cause or causes the augmentations are due. It may be taken for granted that local conditions, so far as these affect death-rates from malarial fevers, are tolerably constant in their action. The variable agent is the rainfall, and its general influence may be shown by the following monthly fever-deaths placed in juxtaposition with the mean rainfall obtained by dividing the total recorded monthly rainfall at 31 sadr stations in the Punjab by the number 31:—

Months.	Fever Deaths.	Mean Rainfall.	Months.	Fever Deaths.	Mean Rainfall.
		Inches.			Inches.
January	31,206	3·4	July	24,962	4·6
February	21,345	0·6	August	23,778	7·7
March	21,481	0·7	September	30,020	1·1
April	20,765	1·7	October	40,934	—
May	27,235	3·1	November	40,659	—
June	26,805	2·2	December	37,573	1·4

This table shows the usual fever increase after the rainy season when drying up and variable temperatures prevail, but the Sanitary Commissioner has further shown that the relation between fever prevalence and rain becomes more decided when its local influence is examined, and he has prepared a table from which the following data are abstracted, giving the fever deaths and rainfall in the four most severely affected districts in 1883, 1884, and 1885:—

Districts.	1883.	1884.	1885.
Delhi.			
Rainfall	11	35	24
Fever deaths	2,878	13,519	11,828
Gurgaon.			
Rainfall	13	21	30
Cholera deaths	2,440	6,973	10,379
Rohtak.			
Rainfall	9	14	29
Fever deaths	1,833	6,951	7,472
Karnal.			
Rainfall	12	33	20
Fever deaths	2,486	14,975	6,470

The rainfall in each case is that of the third quarter of the year, and the fever mortality is that of the fourth or following quarter, and a comparison of the two sets of figures clearly shows that fever follows rain, and the practical remedy is drainage and improvement in dwellings and their surroundings, for it may be safely stated that, where rainfall leads to such results in a district, the houses where fever finds its victims are damp and otherwise unsuited for habitation.

23. Further evidence on the same subject is afforded by a table showing the mortality and its causes in 25 villages in the Delhi district, and 23 villages in Karnal district, situated on the Western Jumna Canal of which the following is a summary:—

District.	Population.	Total Registered Deaths, 1885.				
		Small-pox.	Fevers.	Bowel Complaints.	Injuries.	All other Causes.
Delhi - - -	27,983	—	1,188	63	5	269
Karnal - - -	15,153	2	536	4	—	107

The figures show a great preponderance of fever mortality in these irrigated districts, the actual extent of which may be better estimated by contrasting the general fever-rate for the province with these local rates.

Thus the general fever death-rate for the Punjab in 1885 was 18·40 per 1,000, and its previous mean quinquennial rate was 19·68 per 1,000, while the fever-rate in the Delhi villages in 1885 was no less than 42½ per 1,000, and in the Karnal villages 35 per 1,000. We may also contrast the total death-rates, which for the province were 27 per 1,000, for the Delhi villages 54½ per 1,000, or double, and 43 per 1,000 for the villages in Karnal. Facts of this class have been long known, but it is necessary always to show their annual importance to the public health until they are dealt with.

24. What may be called personal or contributory causes of these fevers are thus described by the Native Civil Surgeon of Rohtak as prevailing in his district:—"The inhabitants are poorly clothed, "poorly fed, unenergetic, and filthy. Almost all classes, partly owing to want and partly owing to "habits, live on coarse and insufficient diet. The clothing of the male members of the poorer "community consists of a waistband or *langoti*, a turban, and a shirt to wrap their body in during "cold weather, while those of the women are equally defective. Their children run about naked, "as if they require nothing at all. Only the well-to-do classes use a shirt or *angarkha*."

This aspect of the fever question has often been referred to by the Sanitary Commissioner, who sums up what he considers to be its practical conclusions in the following words:—"Until the "people themselves have learnt to clothe and house themselves in a manner better suited to the "requirements of the climate, no diminution in the death-rate to any great extent can be expected." It would be contrary to all sanitary rule to ignore or set aside habits of this kind, which no doubt exercise a very important influence on public health in the Punjab as they do everywhere, but we have just shown that, while the habits and customs of the people are more or less uniform, the fever death-rates vary enormously in different districts and localities, affording indisputable evidence that there are other causes at work besides personal habits in determining the amount and fatality of fever. What these are is quite well known, and it is to the removal of them that sanitary work properly so called has to be directed. The apathy of the people is only one of their results. If irrigation be a cause of fever, improved habits will not do the work of drainage or of proper apportionment of water for culture. If local filth be a cause, then means must be taken to remove it, and so of other local causes. The nature of these fevers points to malaria as the cause to be grappled with.

25. Fevers appear to have been of universal prevalence in 1885. Out of 441 registration circles, fever deaths were registered in 435, and, out of 35,338 villages, 30,586 suffered losses from this cause. We have already shown the high fever death-rates prevalent among the rural population of certain districts, but these fall short of the town rates. In one town, Soneput, of 13,077 inhabitants, there were 833 deaths from fever, yielding the enormous fever death-rate of 62·93 per 1,000. This is an exceptional case, but many other towns show great losses from fever, and they have all been under municipal government for several years. It seems as if some technical sanitary engineering aid were required in such cases to direct and stimulate the municipal authorities in the discharge of their duties.

26. *Bowel complaints.*—Deaths registered under this head do not appear to vary greatly year by year. They yielded a death-rate in 1885 of 0·94 per 1,000, against a previous five years' average of 0·95 per 1,000. The district rate was 0·81 per 1,000, but the town rate was 2·58 per 1,000. The bowel complaint deaths registered were 3,385 in the towns and 17,711 in the country districts. About half the towns returned deaths. In the country districts, 407 circles out of 441 registered deaths, but of the villages 5,642 out of 35,338 made returns.

27. The monthly mortality was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	1,078	July - - -	1,598
February - -	709	August - - -	1,570
March - - -	760	September - -	2,018
April - - -	1,045	October - - -	2,291
May - - -	1,585	November - -	1,961
June - - -	1,458	December - -	1,575

There is nothing special in the year's facts. The diseases (diarrhœa and dysentery) are usually allied with local causes such as bad water, filth, and the like.

28. *Injuries.*—Under "Injuries," there were registered 303 suicides and 3,847 deaths from accidents. There were 852 deaths from snake-bite, and 146 from hydrophobia. There were 17 deaths by wild beasts.

29. *All other causes.*—Deaths so classed numbered 127,604, but of the number 27,390 were due to cough and chest diseases.

30. We shall conclude the disease history of 1885 with a brief abstract of the statistics of 4 sanitaria, 33 cantonments, and the Lawrence Military Asylums. The population of the four hill sanitaria, Simla, Dharmsala, Dalhousie, and Murree, on the 1881 census was 19,503, and the deaths were as follows :—

	Deaths.
Small-pox	15
Fevers	161
Bowel complaints	48
Injuries	22
All other causes	118
Total	364

or 19 per 1,000.

The 33 cantonments had a census population in 1881 of 206,689, and the registered deaths in 1885 yielded the following results :—

	Deaths.
Cholera	22
Small-pox	13
Fevers	1,643
Bowel complaints	165
Injuries	51
All other causes	835
Total	2,729

or 3 per 1.000.

It may be safely stated that all the deaths in cantonments were not registered in 1885.

31. *Lawrence Memorial Asylum, Murree.*—The average strength of children in the Murree Asylum, in 1885, was 157. The total admissions to hospital were 71, of which only 6 were from diseases of the epidemic class, viz, three from simple continued fever and three from paroxysmal fevers. There were no deaths during the year.

32. *Lawrence Military Asylum at Sanawar.*—The average strength of children in this Asylum was 499. The admissions to hospital were 793, and of these 5 were from chicken pox, 138 from measles, 4 from simple continued fever, 55 from paroxysmal fevers, 52 from hooping cough, 26 from croup, and 10 from dysentery. There was one death from croup, one death from measles, and 9 deaths from other causes. The year's results at Sanawar cannot be said to be satisfactory, but there is no information about the sanitary condition of this establishment. In former days this admitted of considerable improvement.

33. *Sanitary works (Civil).*—The information under this head includes an account of expenditure for sanitary purposes in 31 districts, which contain 199 municipalities. The expenditure in the towns is not given separately, but by districts each containing from 1 to 15 municipalities. In another list, the number of towns is given at 40, with a population of 1,310,283. Hence it would appear that there are municipal organisations which include other population groups besides the towns. This point is one of importance, because it relates to the area within which authorities exercising sanitary powers have been appointed.

34. The available funds of all the municipalities, including unexpended balances, amounted, in 1885, to Rs. 40,62,861, or in round numbers 400,000*l.*, and the sanitary expenditure was as follows :—

	Rs.
Conservancy	4,48,526
Pavings	71,055
Roads and bridges	1,96,782
Drainage and sewage	71,728
Water-supply tanks, wells, &c.	1,09,557
Latrines	7,447
Other sanitary works	11,574
	Rs. 9,16,669

or about 92,000*l.*; but, as roads and bridges can scarcely be considered as sanitary works, we should have to deduct 19,000*l.* from the amount, and this would leave 73,000*l.* for the real expenditure of the year on public health works and measures. Of the total outlay, including that for roads and bridges, viz., 92,000*l.*, Delhi district, with five municipalities, absorbed 10,000*l.*, Amritsar, with six municipalities, 11,000*l.*, and Lahore, with seven municipalities, had 12,500*l.* It is necessary to refer to the distribution of funds in estimating the actual amount of work done in the year, and the result in the present case is that three districts, including 18 municipalities, out of 199, spent above 33,000*l.* out of the total amount allotted for sanitary works. The money, we take for granted, is mainly that belonging to local funds, and our only reason for referring to it is that no mistake may arise in our estimate of work done from the amount apparently expended on it.

35. Among the sources of income may, we suppose, be reckoned the amount received by municipalities from the sale of town manure, which amounted in 1884 to Rs. 78,695, and had attained in 1885 to the satisfactory increase of Rs. 84,621. And we would simply call attention to the fact that, by common sense management, a mortal disease cause is being turned to a valuable source of income in this province. We know no reason why a similar course should not be taken with town manure all over India. It has been well said that nuisance and consequent disease are the result of wealth in the wrong place.

36. Among the works of the year the following are mentioned, but, in the absence of plans and technical descriptions, we can give no opinion as to their adaptation to local necessities.

A scheme of drainage for the city of *Gujranwala*, with a population of 22,884, had been approved. It is described as follows:—"The city drains are collected into an open masonry drain encircling the "city wall, and from this channel the sewage is led by an open cut to depository tanks, out of which, "after settlement, the liquid is pumped up and allowed to flow over cultivated ground, and the "sludge sold as manure."

A project for the supply of water to the city of *Peshawar*, in continuation of the cantonment supply by cast-iron pipes and hydrants, was being prepared in the Public Works Department.

Another project for the water-supply of *Rawul Pindi*, by filter wells from the river nine miles from the city, wish the necessary ducts and hydrants, was also under consideration.

The drainage scheme for *Deri Ghazi Khan* cantonment was completed and in working order.

A water-supply scheme for *Edwardesabad* cantonment, by which water will be raised 120 feet from wells by turbines to a service tank for distribution, was under preparation.

The *Simla* drainage scheme, by which sewage is to be discharged in a locality which has led to difference of opinion as to its being suitable, was under construction.

Filling up the ditch round the city of *Amritsar* had made good progress, and the reclaimed area was being prepared for public recreation purposes. A low-lying dense garden in a thickly populated part of the city had also been opened out.

37. These larger works have yet to be begun or completed, but the Sanitary Commissioner enumerates, among the year's proceedings, "a great number of minor works, such as erection of "latrines, construction of roads, drains, and bridges, &c., were carried out in all the municipal towns "in the several districts of the Punjab during the year."

The operations at Amritsar already mentioned are cited as the most important.

Local sanitary works are so special in their nature and adaptation to local requirements, that no opinion can be given by us on the influence on health of those alluded to, except that the better cleansing work is done, and the more pure water there is provided the better will it be for the public health.

38. *General remarks and personal proceedings.*—Under this head we learn that the Report under review contains the last record of a long and zealous career of sanitary work with which Mr. Bellew has signalised his tenure of office of Sanitary Commissioner. We have followed his proceedings with great interest, because they have been framed on principles different from those adopted in other provinces. The population is of a higher practical stamp than that of most other regions of India, and the number of municipalities shows that extensive powers of local self-government have been granted to the people. Apparently basing his proceedings on these facts, the Sanitary Commissioner has devoted himself year after year to teaching the local authorities how to help themselves by doing their own work. On every suitable occasion he has delivered addresses, and prepared and circulated information, besides pointing out to the local authorities in what direction their duties could be best exercised, while, in addition to these steps, the Public Works Department has carried out various schemes of public utility. The teacher has done his duty, and it is important to inquire how the local authorities have done theirs. He says, "Ever since my appointment to the duties of Sanitary "Commissioner in July 1876, I have considered it as one of my chief duties to preach to the people "the gospel of sanitation by taking it to them, and expounding its blessings in their very midst." The people, he says, have always given him "a very friendly reception." Has there been a corresponding amount of zeal in execution? Now, in all sanitary work teaching of this kind is of great importance, but beyond it there lies the whole executive region in which principles have to be applied so as to meet local needs in the most simple and economical way.

39. As we have all along insisted, the Indian sanitary problem is essentially a village problem. In the Punjab there are 35,338 villages, and the country population numbers 17,512,378, a more manageable number than that of the larger provinces. The village population yielded 91 per cent. of the total mortality, and nearly 90 per cent. of the total epidemic deaths in 1885. The chief epidemic mortality was due to fevers of a malarial type. The chief remedial measure pressed upon

the village headmen was efficient conservancy and the removal of all manure to assigned places, at least 200 yards from the village walls. "Special attention," he says, "to this simple means of "efficient village conservancy is requisite, as its neglect has tended powerfully to aggravate the evils "brought about by the noxious exhalations arising after falls of rain from the polluted soil and the "decomposing filth scattered broadcast in and around most villages." Similar measures were insisted on for improving the state of municipal towns, including "the maintenance of a conservancy "establishment on a scale adequate to their requirements, and properly organised and supervised." Its special duties would be keeping "the sewage sinks, surface gutters, and drains in proper order, as "well as the latrines, streets, and lanes, . . for it is the neglect of these conservancy measures "or their imperfect performance which destroys the heathiness of towns and villages, and gives full "play to the operation of the prime factors in the pollution of their air and water." He very properly calls attention to the fact that all these injurious agencies can be profitably used as manure, and he concludes, in regard to the towns, that to "an efficiently worked conservancy we must look as "the most efficacious remedy against the most common causes of water pollution and air impurity in "our towns and villages."

It will thus be seen that the great remedy insisted on, after many years of practical experience, is cleanliness and removal of nuisances. This we have all along advocated as a measure within the capabilities of every village and municipal authority. But while urging its adoption because of its real importance and practicability everywhere, we have never advocated cleansing as the sole remedy. The Sanitary Commissioner is quite aware that it would not cover the whole ground, and he urges the importance of personal hygiene in the matters of attention to diet and shelter. "But more "important than either is the item of clothing, especially in a climate such as that of the Punjab, with "its sudden weather changes and alternations of high ranges of temperature and atmospheric "moisture." And he advocates charitable help in improving the condition of the people in these matters.

The Government is fully alive to the great importance of these considerations, but, as is pointed out in their proceedings in this Report, certain of them are matters with which a Government can scarcely deal, but, as they remark, "the remedy must be such as will give them the means of getting "proper houses, clothing, and food." To go beyond this would only increase the evil. "Such "measures, however, as are practical and as are fairly within reach for the mitigation of the sufferings "of the poor the Government is bound to do its utmost to give effect to, and that this obligation is "fully recognized the Report now under consideration bears ample testimony."

40. In the preceding paragraphs we have given a brief account from Mr. Bellews' Report of a particular course of sanitary proceedings, ably and persistently carried out by the Sanitary Commissioner with the entire sympathy and support of the Government. It will have been observed that the whole proceedings have been of an instructional or educational character, while the execution, except for the larger works already noticed, has been in the hands of a purely Native agency, having apparently none of the technical knowledge required for going beyond the application of merely surface work, and, nevertheless, as a considerable amount of cleansing may have been currently done, we should expect to find some of its results to health in the disease statistics. It is necessary, however, to state that not much reliance can be placed as yet on evidence of this kind. Such as it is, we shall notice it:—

(1.) The five years' average death-rate for country districts, which was 28 per 1,000, had fallen in 1885 to 26 per 1,000.
(2.) The town death-rate had likewise fallen from a five years' average of 37 per 1,000 to 32 per 1,000 in 1885.
(3.) The five years' mean death-rate from cholera, which had been 0·07 per 1,000, had risen to 0·10 per 1,000 in 1885.
(4.) The death-rate from small-pox had declined from a five years' average of 0·55 to 0·40 in 1885.
(5.) The fever death-rate had also declined from a five years' average of 19·68 to 18·40 per 1,000 in 1885.
(6.) The five years' average death-rate from bowel complaints of 0·95 per 1,000 had undergone a slight diminution to 0·94 per 1,000 in 1885.

41. But, while stating these facts, it is needful to say that for epidemics a five years' average gives only an imperfect history. During the last 18 years small-pox has become much less fatal. During the same period cholera has been subject to sudden and very fatal periodical outbursts, followed by as sudden subsidences. There has been as yet no marked reduction in the deaths from "fevers," and bowel complaint deaths (diarrhœa and dysentery) remain much as they were.

42. It would be a mistake to conclude that no good has been done, for every efficient sanitary measure is certain to be followed by its reward. This may not be so speedy in arriving as we could desire, because foul subsoils require time for self-cleansing, even after surface pollution has been arrested. Again, it would be an additional mistake to judge of the sanitary state of a country by general death-rates, which are sure to include maxima far above the average in specific districts, and is by attacking the sanitary problem in the worst districts that the general death-rates will be reduced. There are plenty of such cases in the Punjab as in other Indian Governments, and of these it can scarcely be said from the evidence before us that the people are more filthy in their habits and surroundings, or worse clothed or fed, than in places where the death-rates are lower. It is at this point that the Punjab sanitary work has been incomplete, and in saying so it is not intended to

undervalue it in the least. On the contrary, it was indispensable, and was no doubt the best that could have been done with the means at the Sanitary Commissioner's disposal.

Lastly. Where the Government has shown so earnest a desire to improve the sanitary condition of the people, we would merely suggest for consideration whether some further steps might not be taken to increase the efficiency of the sanitary administration itself in the towns and villages, by the application of technical knowledge and experience in public health works. Teaching appears to have done most of what it can do; but, so long as real local disease causes, such as those which predispose to fevers and cholera in houses as well as in districts of country, are in existence, the people are certain to be apathetic, poor, ill clad, and ill fed, and it is only by dealing with this aspect of the question that effect can be given to the benevolent intentions of the Government in improving the physical condition of tne people.

23rd March 1887.

No. 6.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-West Provinces and Oudh for 1885.

We regret to learn that this Report is the last which will be presented by Mr. Planck, whose term of office has expired. It contains much that is of importance to public health work in these provinces, and we shall endeavour to give from it the leading facts and the practical lessons which they appear to teach.

1. Following our usual arrangement, we shall begin with the element of population, which is that of the last census of 1881 returned as made up of—

Males - - -	22,912,556
Females - - -	21,195,313
Total - - -	44,107,869

This total is used in calculating the ratios, although it is probably under the truth from natural increase of population during four intervening years.

2. The registered births in 1885 were of—

Males - - -	957,672
Females - - -	861,607
Total - -	1,819,279

The birth-rate for the whole population was 41·24 per 1,000, which is probably over the truth, because in the municipalities, where the facts can be better arrived at, the rate was 37·26 per 1,000. In either case the high rates are probably in part due to absence of knowledge of the population increase, which at present cannot be estimated with any degree of certainty. Apparently the municipal rate is nearest the truth.

3. During 1885 there died of—

Males - - -	744,039
Females - - -	666,600
Total - -	1,410,639

These numbers give a death-rate on the 1881 population of 31·98 per 1,000. This death-rate divided between town and country populations stood as follows:—

Population of 103 towns, 2,769,598.

Deaths, all causes, 112,409, or 40·66 per 1,000 against a previous five years' average of 38·31 per 1,000.

Population of 49 country districts, 41,338,271.

Deaths, all causes, 1,298,230, or 31·40 per 1,000 against a previous five years' average of 31· per 1,000.

As already stated, the death-rate for the provinces, town and country, in 1885, was 31·98 against a previous five years' ratio of 31·46 per 1,000.

4. The actual registered deaths show considerable variations from year to year, and if the registration were reliable these would, nevertheless, yield no great change in the average annual mortality, but taken as they stand in the table they would appear to show some annual irregularity in the registration machinery rather than in the condition of public health for the years.

5. The Sanitary Commissioner describes fully the method of recording the facts at present in use. This is, no doubt, of a rude character, but it seems to afford a good basis for improvment in reporting.

6. As usually happens, there is a great difference in the death ratios of different towns and of different districts. The lowest town death-rate of the year was that of Hardoi, 18·75 per 1,000, but the rates generally much exceed this average. Rates above 40, 50, 60, 70, and 80 occur in the tables. The town of Sikanderabad, out of a population of 16,479, lost 1,842 of its inhabitants, or 111·77 per 1,000, and Ajudhia, out of 11,643, lost 1,482 people, or 127·28 per 1,000.

7. The district death-rates did not present the same anomalies, but they, nevertheless, showed considerable differences, lying between 18·86 per 1,000 in Dhera Dun, 49·59 in Moradabad, and 52·55 in Bulandshahr. Most of the death-rates lay between 20 and 40 per 1,000.

8. The per-centages of deaths at different ages stood as follows:—

Infants and children to the fifth year	46·9
Fifth to the 30th year	18·2
30 to 60 and upwards	34·9
	100·0

This abstract gives a large mortality under five years of age, and the returns show that the death-rate on infants under one year was no less than 332·07 per 1,000 of their number.

9. *Causes of Death.*—The following were the deaths registered in 1885 under the usual heads:—

Diseases.	Registered Deaths, 1885.	Deaths per 1,000 of Population.
Cholera	63,457	1·44
Small-pox	14,593	0·33
Fever	1,124,150	25·48
Bowel complaints	64,409	1·46
Injuries	22,401	0·51
All other causes	121,629	2·76
All causes	1,410,639	31·98

This table shows that nearly 90 per cent. of the deaths in these provinces were due to diseases of the epidemic and endemic class, carrying forwards for another year the conclusion long since arrived at that the sanitary problem in India is neither more nor less than the mitigation or prevention of epidemics, in other words, that it must be dealt with by active and skilled sanitary works and measures. This has been conclusively shown by the reports of Sanitary Commissioners.

10. Beginning with *cholera*, the first disease in this abstract, we find that its history as an epidemic for the last 21 years has been as follows. The first 12 years in the table give the ratios of cholera deaths per 1,000 of population for the North-West Provinces, and the remaining years include the mortality for these provinces conjoined with the ratios for Oudh.

Years.	Deaths per 1,000.	Years.	Deaths per 1,000.
1865	2·53	1876	0·85
1866	0·27	1877	0·74
1867	1·95	1878	0·52
1868	0·64	1879	0·84
1869	3·06	1880	1·67
1870	0·44	1881	0·58
1871	0·11	1882	2·02
1872	1·64	1883	0·41
1873	0·49	1884	0·68
1874	0·20	1885	1·44
1875	1·33		

With the solitary exception of 1869, which was a great epidemic year, and also the year of the chief Hurdwar festival, at which 3,900,000 of people were said to have been present, it cannot be said that the losses from cholera show any great departure from the annual average, and it may be safely assumed that they afford no evidence that the local predisposing causes have undergone any diminution in their force.

11. But the annual averages taken over great areas of country convey only an imperfect idea of the actual facts. Thus, of the 49 districts in the provinces not one escaped cholera in 1885, although in four districts the deaths were at and under six in each. Several towns appear to have made no returns, but including these 37 towns out of 100 had no deaths from cholera. In the districts there are 105,421 villages, but all the deaths were yielded by 6,752 of them. The country population, numbering 41,338,271, had 59,373 deaths from cholera, and the towns, with a population of 2,769,598, reported 4,084 deaths. The district cholera death-rate was 1·43 per 1,000, the town rate was 1·47, and the rate for the entire province was 1·44 per 1,000, against a preceding five years' average of 1·06 per 1,000.

12. The district death-rates varied considerably. In some cases they scarcely admitted of tabulation, but effectively the rates varied from a minimum of 0·06 per 1,000 to 5·67 per 1,000 in Bahraich, which yielded the maximum rate of the year. In the towns the death-rates also varied greatly. In some they were scarcely appreciable for practical purposes, but in others they were very great. Among the latter must be ranked the case of Sahtawar, in Ballia, where out of 11,024 people 186 died of cholera, equal to 16·87 per 1,000, and Barhaj, in Gorakpur, where 11,715 inhabitants lost 218, or 18·61 per 1,000.

13. The Sanitary Commissioner has given an interesting table showing the annual death-rates in each district for a period of 16 years, and we shall quote his own remarks upon it: —"Thus, its ratios " appear to show unmistakeably that for 16 years the disease has never been epidemic to a serious " extent in the Saháranpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Etah, Muttra, Manipuri, " Agra, Etáwah, and Cawnpore districts, forming the western portion of the Doab, their mean rates " being only 4·4 per 1,000 of the population. And without doubt the Upper Doab, as represented " by Saháranpur, Muzaffarnagar, and Meerut, with their mean of 2·3 deaths from cholera per 1,000 " of population in 16 years, is the land of greatest freedom from the disease. And the statement " shows that the six districts, Gorakpur, Basti, Gonda, Bahraich, Kheri, Pilibhit, and Tarai, which " skirt the Himalayas, are the country of great suffering from this cause, their mean ratio for the " 16 years being 36·5." We have here a very interesting topographical fact as regards cholera, namely, that in the epidemic region of these provinces there are parts whose aggregate mortality during a period of 16 years has been sixteen-fold the death-rate of other parts in the same region. The facts would appear to point to local causes or to topographical conditions as having influenced the death-rate, but they also suggest further inquiry under both heads.

14. The following abstract gives the registered monthly deaths from cholera in 1885 :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	135	July	2,429
February	44	August	10,853
March	345	September	11,960
April	3,474	October	19,104
May	2,368	November	7,153
June	1,815	December	3,777

This table presents some unusual figures. There was an outburst of the epidemic in April and May, and a second far more severe outbreak later in the season, which the Sanitary Commissioner considers as having probably been connected with cessation of rain. Perhaps the best way of illustrating this point will be to extract from the meteorological section of the Report a few notes bearing on the subject :—

January.—Rainfall above the average, but defect in four divisions.

February.—Rainfall below the average; none fell over most of the country.

March.—Everywhere below the average.

April.—Rainfall less than half the average, mean only 0·14 inch.

May.—Average in the three eastern divisions deficient. Elsewhere greater than usual.

June.—Above the average, and very high in certain districts.

July.—Much above the average.

August.—In excess by 6·66 inches in all divisions.

September.—Rainfall everywhere below the average, except in Benares division.

October.—Rainfall deficient everywhere.

November.—No rain fell, except a few showers in two districts.

December.—Rainfall above the average by nearly two inches.

We have already seen that the deaths from cholera in the provinces in 1885 were 63,457. Of this number 49,070, or nearly 80 per cent., took place in August, September, October, and November, and with the exception of the month of August, which had an excess of rain, in the other three months the rainfall was below the average. This experience is not exceptional. It rather shows by a specially illustrative case the relation of the amount of rain to the prevalence of cholera during an epidemic season, and it bears out the remark of the Sanitary Commissioner, that "in no other year of " the mortuary record have the rains ceased at so early a date, or has cholera prevailed to such extent " in the last quarter of the year." It appears that absence of cleansing by rain and non-renewal of the water-supply from the same defect, in this as in so many other well known cases, led to increase of local causes, and hence to augmented mortality.

15. The cholera history is followed by the usual map showing the distribution of this disease, together with an interesting table exhibiting the cholera mortality in every circle of registration, together with the dates of attack and the number of affected villages in each circle. No special reference is made to local predisposing causes, which, no doubt, were of the usual character.

16. *Small-pox.*—This abstract shows what has been the annual mortality from small-pox in ratios per 1,000 per annum of the population for the last 16 years :—

Years.	Ratio per 1,000.	Years.	Ratio per 1,000.
1870	0·8	1878	3·9
1871	1·2	1879	1·7
1872	1·1	1880	0·1
1873	2·8	1881	0·3
1874	2·5	1882	0·6
1875	0·7	1883	3·1
1876	0·9	1884	4·5
1877	0·8	1885	0·3

The law in time of small-pox epidemics in the North-West Provinces and Oudh is clearly shown by bracketing the years of high and low mortality separately in this table. Vaccination has been in use during the entire period, and yet the epidemic recurrence for two years at the end of three years of comparative quiescence remains the same throughout. Indeed, the most severe epidemic period of the whole series was included in the two years 1883-84, at the end of 13 years' vaccination work.

To all appearance we must accept the conclusion that whatever benefit may arise to a population from the modifying agency of vaccination this measure has no influence on small-pox as an epidemic.

We have no means of ascertaining how many lives may have been saved by vaccination, but the conclusion forced upon us by the facts is, that in its epidemic form this pestilence must be met by other measures in addition to vaccination. The disease must in fact be dealt with as other Indian epidemics must be met, namely, by thorough sanitary improvement of the localities and dwellings occupied by the people.

17. In 1885 there were registered 14,593 small-pox deaths, or ·33 per 1,000 of the population, against a previous five years' average of 1·78 per 1,000, which, however, included a two years' epidemic, that of the preceding year, 1884, having occasioned the deaths of 202,541 people. The 49 districts, with a population of 41,338,271, returned 13,735 small-pox deaths in 1885, or ·33 per 1,000, and the town population of 2,769,598 returned 858 deaths, or the same rate as the districts. All the districts except Meerut returned deaths, but 49 towns out of 103 escaped the disease. Of the total small-pox deaths 3,712 were in children under one year of age, and under 12 the deaths were 6,282.

18. Out of 1,150 circles of registration 431 returned deaths, but as these were scattered over the whole 49 districts, the attacks were local, and this character of the disease is further shown by the fact that all the deaths were yielded by 7,133 villages out of a total number of 105,421. This was a very different experience from that supplied by the epidemic of 1884, which covered 943 circles of registration, and took its victims from 42,663 villages, while we may safely assume the amount of protection from vaccination to have been the same in both years. The exceptional case of Meerut district, which escaped the disease, is attributed to vaccination. This, like all other exceptions in public health questions, is of great importance, and it may be suggested for consideration whether it would not be advisable to institute a thorough examination into the facts.

19. *Vaccination.*—From a table given in the Report it appears that during the 14 years 1872-85 the vaccinations have amounted to 7,460,166, so that, including those who have died after vaccination, the operations performed in all these years have been only equivalent to one-sixth part of the present population.

20. In 1885 the vaccination staff was as follows :—

Deputy Sanitary Commissioners of circles	3
Deputy Superintendents	7
Native Superintendents	56
First Class Vaccinators	279
Second Class Vaccinators	389
Chaprasis, &c.	63
Total staff	797

The total successful vaccinations and re-vaccinations performed by this staff in 1885 amounted to 595,644.

The ages of subjects of vaccination are not given in the returns, but, as we have already shown, there were 1,819,279 births registered, or more than thrice the total vaccinations at all ages. These facts show how hopeless a task it has been to cover the ground by vaccination alone. We have the disease to deal with, and we have an accredited remedy for it in vaccination ; and then we have the startling fact that hitherto the remedy has only covered a corner of the ground, while there is no hope apparently of the disproportion between the births and the vaccinations being different from what it is. We are not at all questioning the saving of life and useful working power by vaccination. We are only desirous that the facts as they stand should be calmly considered. So far as our own view is concerned, we have often insisted that small-pox is only one of the Indian epidemic and endemic

diseases, and that, in its epidemic form, it can only be successfully coped with by the same executive preventive measures as are required against the whole tribe of them.

21. *Fevers.*—Deaths registered under the fever heading were by far the most numerous of all assigned death causes in these provinces, for no fewer than 1,124,150 deaths were so classified. Of fever deaths, 1,041,920, or 25·20 per 1,000, were returned from the country circles, and 82,230, or 29·74 per 1,000, from the towns. The death-rate assigned to fevers for the provinces was 25·48 per 1,000, against a previous five years' ratio of 23·08 per 1,000.

22. Every district and every town suffered losses from fever in the course of the year. Deaths from it were returned from 1,124 registration circles out of 1,150; and although the number of attacked villages is not stated it is highly probable that few escaped its influence. As usually happens, some districts suffered much more than others. The lowest district fever death-rate of the year was that of Lalitpur, which was 7·62 per 1,000, and the highest rate, 51·29 per 1,000, was returned from Bulandshahr. In the same way the town fever rates varied greatly. The lowest town rate, 10·77 per 1,000, was that of Lalitpur town. But, generally speaking, the town death-rates were excessive, in many cases exceeding 20, 30, and 40 per 1,000. As examples of extreme rates we may cite the following towns, all of which are under some form of municipal government, and are supposed to be entrusted with power to protect the health of their people:—

	Per 1,000.		Per 1,000.
Sahtawar	41·18	Bulandshahr	54·30
Kaimganj	48·74	Adjhudia	70·77
Mainpuri	48·77	Sikandarabad	74·09
Aligarh	52·86	Khurjah	84·81

23. In most of the towns the evidence appears to be conclusive that the local authorities are either in total ignorance of the measures required for preserving health, or they have neither means nor powers sufficient to apply them. But in making this remark it should be borne in mind that the town fever question is closely connected with the district fever history, and this is now known to be intimately related to local irrigation and drainage, both of which elements may be safely assumed as being constant quantities, represented by average fever-rates, but liable to increase under the influence of rainfall, which the Sanitary Commissioner shows was above the average in the worst districts and towns.

24. The following were the monthly fever deaths registered in 1885:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	73,415	July	62,443
February	53,544	August	80,706
March	67,359	September	110,987
April	74,136	October	166,845
May	77,102	November	154,794
June	71,533	December	126,286

We have already seen that in July and August the rainfall was above the average, but that it fell off and ceased in the subsequent months, which became the months of drying up and of temperature variations, and then the fever mortality rose, especially in districts which had received the largest increase of rain.

25. Facts of this class are fully known, and their importance acknowledged by the authorities; but the Sanitary Commissioner has shown us how the balance of rainfall, as against means of drainage, affects the health of towns and even houses, apart from ordinary insanitary conditions. He says:—
"As an inch of rainfall supplies one hundred tons of water per acre, it may be safely concluded that "an average excess of 98,600 tons was supplied to every acre" (? 100 acres) of the districts in "question during the year of report. And this, it is to be remembered, in a country much cut up by "recent works of embankment connected with canals and roads and railroads, and much watered by "canal irrigation, for all the districts in the list are so irrigated, and have the spring level in their "land permanetly raised many feet above the ancient level. It can therefore be readily understood "that any excess over the average of rainfall must further raise that spring level," and he brings home the effect of this rise on the dwellings of the people as follows:—"Dampness creeps into the "walls of a mud-built house, even up to the tiles of the roof, in low-lying centres of population in "the Upper Doab country. That, under such circumstances, fever disease should prevail is only in "accordance with expectation." If this statement of the case is to be accepted as reliable, we must adopt the conclusion that public works have added to the death-rate of the country, and that steps should be taken to apply a remedy to the evil so far as it may be practicable to do so, while the facts of the case show the need of providing sanitary knowledge and experience to prevent similar disastrous results in future.

26. *Bowel Complaints.*—Under this head there were reported 64,409 deaths, or 1·46 per 1,000 of the entire population. This death-rate was under the previous five years' average, which had been

1·81 per 1,000. The rate for the country population was 1·35 per 1,000, but for the towns it was 3·08, or more than double. Although the death-rate was under the average, the diseases classed as bowel complaints prevailed very extensively in these provinces, for, out of 1,150 circles of registration, 1,053 returned deaths from them. The number of affected villages is not stated in the returns. With very few exceptions all the towns returned deaths, and, as usually happens, the mortality varied considerably in different localities.

27. The monthly deaths registered stood as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	4,250	July	4,717
February	3,554	August	6,407
March	3,744	September	7,543
April	4,533	October	7,891
May	4,702	November	6,803
June	4,506	December	5,759

The mortality appears to have been greatest during the warm, moist months, and it followed the same law as that from cholera. The real nature of diseases classed as bowel complaints is only imperfectly known. Most of the deaths appear to be due to dysentery and diarrhœa, and would hence follow the same law of relation to local causes as other endemic or epidemic diseases.

28. *Injuries.*—Under this head there were registered 2,360 suicides, of which 597 were in males and 1,763 in females. There were 14,080 deaths from wounds and accidents, and 5,961 from wild beasts and snake-bites, making an aggregate of 22,401 violent deaths, or 0·51 per 1,000 of the population.

29. Of deaths under *all other causes* there were 121,629 registered.

30. The disease history in the present Report is concluded with a very interesting practical table showing the death-rates from small-pox, fevers, and bowel complaints in each registration circle in the North-West Provinces and Oudh, and this table, in conjunction with the table showing the distribution of cholera, affords most of the information required for dealing with the diseases and their local causes in every circle, if only there were means available for making use of the information.

31. Before leaving the subject of disease history, the Sanitary Commissioner makes some pertinent remarks on registration of deaths, and the constant tendency to refer doubtful death cases either to the head of "fevers" or "all other causes," and so to increase the fever mortality far above its real amount. We have often called attention to this point with the view of improving the diagnosis, but there are other elements which require to be considered separately, such, for example, as the greatly differing proportions of deaths assigned to fevers in irrigated and unirrigated districts, which cannot be accounted for by errors in diagnosis, or those epidemics which at times sweep over the country with the force of great pestilences, attacking all ranks, and, as it has happened, even leaving crops on the ground with no hands to reap them. That there are grave diagnostic errors there can be no doubt, and it is equally true that the fever heading is made to include many deaths not properly classed, but, on the other hand, we must take the admitted fact that the actual fever mortality is very great, and that it has been clearly connected by long continued observation with well known causes of fever. We do not know enough for scientific diagnosis, but we know what is quite sufficient to warrant our insisting year after year on the necessity of improving the drainages of the country, and the habitations and surroundings of the people.

32. *Cantonments.*—We may conclude this abstract of the disease history of 1885 by giving a brief summary of the cantonment registration for the same year. In the North-West Provinces and Oudh there are 24 cantonments having an aggregate population of 193,049, among which the following deaths were recorded :—

Cholera	62
Small-pox	7
Fevers	2,864
Bowel complaints	170
Injuries	64
All other causes	1,042
All causes	4,209

The registration in these cantonments is not in a satisfactory state, at least in all of them. In 14 the death-rate is under 20 per 1,000, but in 10 it exceeds this ratio. Cawnpore registered a rate of 36·72, and Fategarh of 46·63 per 1,000. As bearing on the question of fever diagnosis we have been discussing, it should be stated that in these cantonments, where diagnosis of death causes ought to be more nearly correct than in country circles, the fever death-rate in 1885 was 14·8 per 1,000, which may be compared with the general fever-rate of 25·48 per 1,000, bearing in mind, however, that the deaths registered in cantonments were below the truth. If we compare the ratios of fever deaths in cantonments with the total deaths and those among the entire population, we should have

68 per cent. of the cantonment mortality assigned to fevers against 79 per cent. among the civil population. But here again we must take into account that the cantonment population is under a certain amount of sanitary control and care which would tend to lower the fever ratio.

33. *Sanitary Works (Civil).*—The information contained in this section is given in brief notes relating to sanitary work done in 69 localities in as many districts. Each town has its income, of which a certain proportion is expended annually for public health purposes. The cases cited are given not as including all the work done in the municipalities, but as examples. Viewed in this light they may be described as showing, in the first place, that the town revenues are by no means great, and hence that the per-centages set apart for sanitary purposes do not represent much outlay. Such as it is, the money appears to be spent not in expensive works, but in surface improvements, chiefly such as drainage cuts and channels, paving, providing stone, gutters, filling up holes, and general surface improvements, cleaning out, deepening, and improving wells, water tanks for flushing out surface gutters (an important improvement), providing latrines, general conservancy, tree planting, and such like.

34. All this is work in the right direction, and no doubt certain superficial disease causes will be removed by it. Our only difficulty, in the absence of sanitary engineering reports on the localities, is to know to what extent disease causes can be met by such methods. We are obliged to state the case in this way, because, on referring to the tables of town death-rates, we find that a previous five years' average death-rate of 38·31 per 1,000 had increased to 40·66 per 1,000 in 1885. With such facts before us, no amount of surface work can be accepted as a substitute for subsoil cleansing and draining. There must not only be sanitary work done, but it must be the work required locally, and this is the reply to any argument that might be put forward from the statistics against the benefit of sanitary work.

We may safely, therefore, accept the statement of the Sanitary Commissioner, "that nowhere in "the world can more anxiety be evinced by the local authorities to do good sanitary work when its "necessity and public advantages have been pointed out," while we may, nevertheless, doubt whether the real disease causes have been recognised by the municipalities or have yet been reached by their proceedings.

35. In a former Memorandum we instanced the case of Adjudia, with its enormous death-rate of 88·8 per 1,000, as apparently justifying a suggestion to remove the people from the town. This rate is called in question in the Government Resolution on the present Report, on the ground of probable error in the element of population. As the case is one of considerable importance, we shall give the facts for 1885 as they stand in the tables:—

Population (1881), 11,643.

Diseases.	Deaths.	Ratio per 1,000.
Cholera	67	5·75
Small-pox	7	0·60
Fevers	824	70·77
Bowel complaints	223	19·15
Injuries	13	1·11
All other causes	348	29·89
All causes	1,482	127·27

The death-rate in 1885 was thus 127·27 per 1,000, while the previous five years' average is stated at 92·58 per 1,000.

Now it is evident that such a case as this requires special investigation. It may be that, as the Government Resolution implies, there may be a gross error in the population element, or, if this town is liable to a great influx of people at different periods, whose deaths are counted against the fixed population, the error, if such there be, may have arisen in this way. But are we not justified in asking for inquiry in order that the real facts may be brought to light?

36. *General Remarks.*—This section contains an abstract of the Sanitary Commissioner's inspecting work during the year, but we shall restrict our notice of it to those portions which refer to our own special object.

As the present Report is the last one we shall receive from Mr. Planck, we shall give his own summary of his experience, which extends over a period of 18 years. After stating, what is no doubt correct, that no English official has ever had the opportunity which he has had of becoming acquainted with the Indian population, he proceeds:—"A more polite or considerate people than "those of the North-West Provinces and Oudh does not exist perhaps in all the Empire, or a people "more worthy of great and earnest effort for their sanitary welfare at the hands of all men trusted "with authority.

"The centres of population, as first known to me, presented an appearance of much neglect. The "local officials of supreme authority, as a rule, gave little thought to sanitary conditions. In old "days, indeed, I have walked with many authorities, in unwholesome lanes of a city site, to their "display of much disgust, holding of noses, and rapid departure to a place of purer air. But never "could anything of evidence be discovered favouring the idea that the authorities were in any "measure to blame for this condition of things. Plainly indeed the view was expressed that if the "Natives chose to live amidst such insanitary surroundings it was their own concern."

"As a fact, however, the local authorities had as little knowledge or thought of the true death "penalty of a city or town as of their true position of the people's defenders against insanitary "conditions. Conditions not born of any desire or fault of the people, but inseparable, until the "authorities shall interfere with decision for their remedy or prevention, from the life circumstances "of many families closely associated."

37. In those days there was no idea in India, as there was not in some other countries, that preservation of health, and consequent increase of working power of the population, formed an essential part of the function of Government. So far as can be estimated from the facts, the first step in advance must be traced to the Report of the Royal Commission of 1859, but before the report was issued individual medical officers had drawn attention to the subject, apparently without result. It is, however, more satisfactory to learn from Mr. Planck's report that a more accurate estimate of the importance of public health work is being formed. "At the pressnt day," he says, "I have good "reason to believe that much of this spirit of apathy, or willingness to acquiesce in long-established "malpractices or insanitary evils, has given place to an ardent desire for improvement. . . . . "To a certainty the existing local authorities are evincing as a general rule an interest and anxiety about "sanitary improvement, such as a generation of authority now passing away never practised, or "indeed seemed to think desirable." But he says that to every rule there are exceptions, and there are people who put forward what he calls "the monstrous argument" that the premature killing off of the population is "nature's law" to prevent the land being overburdened with population. This view is put forward in apparent ignorance of the fact that high birth-rates are among the best indications of unhealthy populations. It appears also that there are medical officers in India who, being themselves unacquainted with the elements of sanitary work, express their wonder as to what Sanitary Commissioners find to do. But, further than this, Mr. Planck informs us that there are opposing forces at work similar to those with which sanitarians had to contend in England in former days. He says, on this subject and referring to the office of Sanitary Commissioner, "Unfortunately its "chief concern has been to search out and openly denote conditions or circumstances other than "those which provide proof of perfect management, and that being so, enmity could hardly be "avoided, or even expression of joy about the possible abolishment of the office at the first favourable "opportunity." This merely means that some officers entrusted with the functions of local government have been unacquainted with one of their most important duties.

38. Having said this much about obstructions, it is more satisfactory to quote Mr. Planck's account of what has been done in the way of improvement. His inspection of a large number of towns has led him to the conclusion "that the towns have in a great measure assumed an appearance of sanitary "improvement most creditable to the local managers. . . . This improvement is manifest, "chiefly in regard to cleanliness of the surface, improvement of the drainage, consolidation of the "thoroughfares, and even the making of pavements for foot passengers. In some towns the planting "and growth of trees has made good progress, and in some even a commencement of persistent "flushing of the drainage ways by a trickling stream of pure water has been established."

This surface work has, as a matter of course, removed bad smells and purified the air apparently at least. "Almost everywhere the improved arrangement and constructions for the speedy removal of "excessive rainfall are a marked feature of advancement in sanitary endeavour." Much good work has been done in this direction, and Mr. Planck considers that it proceeds satisfactorily. As we have seen, Mr. Planck includes these points under the general term of "appearance of sanitary "improvement," which they unquestionably merit to be considered. But supposing the towns had always been in this condition, would their disease statistics have been other than they are?

39. After 18 years of most efficient sanitary inspecting and advising work, Mr. Planck has told us what the last six years' death-rates have been, and these we have already discussed. If the death-rates have not fallen, this has been no result of deficiencies in Mr. Planck's work. Year after year we have pointed out how excellent the work itself has been within the limits assigned to it, and we shall now see what he himself says about fatal sanitary defects which he has been compelled to leave behind him.

40. On the cardinal point in relation to epidemic predisposition, namely, cleansing of town sites, he says:—"I have long experienced, and still have, prevailing anxiety. . . . Only in a few "towns has this most important point received any consideration. . . . Most of the towns are "still cursed with the affliction of badly constructed cesspools, the contents of which, being house "sewage, leak out into the well, or are frequently thrown out upon the neighbouring land to dry up "in the air or to sink into the subsoil." In most towns arrangements are made for cleansing these pits, "but the work is not well done," and thus "much of impurity, coming direct from private "retiring places, finds its way into the soil beneath the houses and thoroughfares. . . . And, as "it is quite just to say that *little* has yet been effected for the cleanliness of the soil, so it is right to "record that *nothing* has yet been done with a view to placing a supply of good drinking water "within reach of the crowded people of any city site. . . . Much is done, and some money is "expended in every year for the removal of the actual black filth deposited at the bottom of the "wells in almost all towns, but the water which comes back into the well is the water of the impure "subsoil;" and he states that what this impure condition really is may be estimated from a calculation showing that a town site occupied by 100,000 men would have passed into it under existing practices in a century 27,418,870 hogsheads of cesspool sewage, for which there is no outlet except into the wells, or into the atmosphere of dwellings and thoroughfares. "This is a sad account," he says, "but it is very true, and the opinion results from quantitative analyses of many samples taken

from many wells, in many towns, and, nevertheless, a good water source is easy to find for any city in this province."

41. We have thus, at the end of 18 years' work, an acknowledgment that no city or municipal town is as yet drained or supplied with good water, and that the subsoils and subsoil wells are all more or less polluted with the excreta of men and animals. It must further be pointed out that the surface improvements already noticed are stated to have been found only in certain towns. If all were similarly improved the number would be 103 and the population 2,769,599. No reference, however, is made to the condition of the villages, of which there are 105,421 in these provinces, with a population of 41,338,271.

42. There are other very serious disease causes connected with irrigation and drainage works affecting the country as a whole, which we shall presently refer to. Our remarks are intended simply to direct attention to these facts regarding the towns, and the condition in which the Sanitary Commissioner has been obliged to leave them after strenuous endeavours to press forward improvements under the existing methods of administration.

43. The Sanitary Commissioner explains that he is precluded from entering into details of his inspections, but, as an illustrative case, he cites the condition in which he found the great pilgrim city *Benares*. "Cholera," he says, "is endemic in the city, deaths occurring from that cause in "every year, and the local authorities seem to lean to the belief, as expressed to me, that the pilgrims, "who come in great numbers, bring the disease. But the pilgrims are of quite another opinion, and "firmly believe that men coming in perfect health to Benares are attacked with the disease there."

The chief visible sanitary defects were as follows:—First, the foul state of the river; and, as described by a Hindu gentleman to an English traveller who went to see it, mention may be made "of the trickling fœtid stream, the mat retiring place, the filth-feeding pigs upon the banks, and the "discoloured river margin, where the Hindu women are dipping water for their household use."

Mr. Planck himself gives the following note of an inspection made on 17th January 1886:—

"First, a great sewer which comes down almost to the water's edge, pouring a considerable stream "of black coloured sewage into the river, to the continuous discolouration of the water for a long "distance down the stream, and the creation of an overpowering stench. I see quite a crowd of men "and women bathing in this discoloured water." After striking the surface water is taken for domestic use. There are numerous male retiring places, the drainage of which increases these evils. This great sewer poisons the water for a mile of frontage. It was made a long time ago, but "certainly since the city came under British rule. And to me it is a cause of wonder how any "British authority could have thought it was a good thing to give the sewer entrance way so exactly "above the chief bathing places of the locality. To bathe in the Ganges daily and to drink its water "is the paramount delight and duty of every Hindu resident, and surely even common decency would "dictate that to mix sewage with the water they must use was to deal hardly with a people least of "any given to complaint."

It is right that this case should be thus stated, but the barbarism of throwing sewage into the rivers above water-sources and supplies for domestic use is by no means confined to Benares.

"A second great sanitary defect of Benares is the condition of certain large excavations in the midst "of the habited site which, as a fact, are utilized as the great dust-bins of the city. . . . . "To these excavations much of rainfall and other drainage converges, and their general condition is "a disgrace to the city and a source of ill-health to its people."

"A third great sanitary defect in Benares is the extremely unwholesome condition of the minor "drainage ways in the crowded city site. Being of defective level and improperly planned sewage will "not flow, but stagnates in them." This brief abstract will show the nature of insanitary conditions in Benares, but under the surface lie all the many questions connected with house sanitation. In 1885 this city of 193,025 inhabitants had a death-rate of 33·88 per 1,000, and its previous five years' average was 40·99 per 1,000.

44. We shall next notice briefly the local causes of district fever mortality. The present Report contains no new information on this subject, but it raises some practical questions of importance. The Sanitary Commissioner says in regard to the Doab:—"A more fertile or thoroughly utilized "land it would be hard to find, and its villages are fairly numerous. But the people are not blest "with health. Go where you may in this Doab men may be seen, young or in the prime of "life, sad of face and slow of step, with abdomen so prominent as from a distance to give origin to "the idea that they must be women in a condition which commands respect. . . . . But nearer "approach shows that they are men, and that the prominence is spleen enlargement filling all the "front of the abdomen." This spleen disease is a frequent result of malarial poisoning on its way to destroy life.

An example is given in the case of Shamli town as illustrative of the results of irrigation without drainage. It is quoted from the official record, not of a medical officer, but of an executive engineer of the Eastern Jumna Canal, and bears date 25th November 1885:—"When there was no "canal, when the country was dry and parched all round, when higher fields were kept green by "water drawn up in bags from a depth of 30 and sometimes 50 feet, then Shamli was a pleasant city "in a green valley. . . . . (It suffered occasionally from fever.) Then Shamli was in a place "where a town should be. But now that water is plentiful everywhere and the ground is sodden, "the green valley has become a noisome fever hole, and the town is but a crumbling ruin." He further describes the people as sterile and dying out. In former times water was found 40 feet from the surface, while now it is reached at a depth of seven feet.

45. Mr. Planck has formed the conclusion that when in the Doab water rises within 10 feet of the surface there is danger to health. Other estimates differ from this, but much no doubt depends on the nature of the soils and subsoils, and on the general slope of subsoil drainage where it exists. The fatal element is stagnation, with perpetual dampness of sites and houses, together with pollution of wells; the causes of this condition of localities are primarily want of drainage, irrigation, obstructions caused by works of various kinds, excessive rainfall, especially where the natural drainage channels have been interfered with, and the object to be aimed at by sanitary measures is to secure just enough water for cultivation, and so to avoid all water-logging. It would appear as if there was old experience to show that, in certain districts at least, irrigation and drainage were effected at the same time by the primitive expedient of drawing irrigation water from the subsoil, whereby the subsoil level was kept low and the raised water performed the functions of canal irrigation. It appears to be unnecessary to discuss this point more in detail, the facts are now generally admitted, and also the required remedies, but the great difficulty is in their application.

46. In the preceding paragraphs of this Memorandum we have confined ourselves as far as possible to a simple statement of facts, and it need hardly be said that, viewed from the side of public health requirements, they amount to a most conclusive proof that real effective sanitary work has yet to be undertaken in these provinces. Mr. Planck has done his duty faithfully in exposing the present evils under which this vast population suffers, but he could of course only indicate the remedies very generally.

On the established principles of sanitary administration and work, the remedial measures required involving, as these must necessarily do, not only local technical sanitary engineering inspections, and plans of works, but also the large question of local economy in planning and execution, can only be decided by officers trained in such duties. Whether the advice of the Royal Commission of 1859 in their 32nd recommendation, or some course equivalent to it, should not even now be followed, it is for the Government to decide. All we can do is to express our very decided opinion that the present state of matters should no longer be acquiesced in. This conclusion is forced on us by the acknowledged result of 18 years of effort to deal with the sanitary problems presented by 44 millions of people, on principles not in accordance with the necessities, and which would not now be accepted as in any degree affording a chance of success in any country where sanitary administration or work has been in progress.

47. Lastly, we are desirous of directing attention to the cases of Benares and Shamli already mentioned. The city of Benares, although not taking rank among the more unhealthy cities of the North-West Provinces, is a place of great celebrity all over India, and as such is liable to large influx of pilgrims and to occasional outbreaks of cholera. In this instance a professedly sanitary work has been so planned and executed as to lead to serious nuisance and risk to the public health. We would suggest whether this case might not be taken in hand at once, and a safe outlet for the sewage provided, while at the same time the other well-known insanitary conditions of the river front and of the city generally might be dealt with.

Shamli presents an example of an important public work, intended to increase the productiveness of the country, having been so planned as to produce the lamentable results to health described in the present Report. The Doab Canal passes it at a distance of about three-quarters of a mile, and at a higher level than the town, so that the canal water percolates into the subsoil, and has raised the subsoil water level. "The spring level of the dry season," says the Report, "varies from five to seven "feet from the surface. The floors of the houses are universally damp, even in the main way. The "water in the wells is of unpleasant taste. The general aspect of the people is extremely unhealthy; "excessive spleen enlargement is frequent amongst them." And the population is rapidly decreasing. In this instance we have a distinct example as to how malarial disease of the worst type can be produced, and what is now required is that the evils be remedied.

There are many other similar cases to be dealt with, but might not this one be taken in hand at once, and experience be obtained as to the best practicable methods of dealing with them?

25th February 1887.

No. 7.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the CENTRAL PROVINCES for 1885.

1. The population of the Central Provinces in 1881 was returned by the census of that year as 8,817,185. Of this total, 8,060,093 were returned for the rural population, and 757,092 for the 73 towns.

2. The births registered for the whole province in 1885 were—

Of males	206,439
„ females	193,532
Total	399,971

or a birth-rate of 45·36 per 1,000. The lowest rate was that of Burhanpur district, which was 33·49 per 1,000, and the highest, 50·35 per 1,000, was that of Saugor. In the Sadr towns the birth-

rates lay between 27·52 at Murwara and 50·48 per 1,000 in Narsingpur. These birth ratios are so high as to render it doubtful whether part of the births had not taken place among immigrants as well as among the natural increase of population, while the population of 1881 is credited with that increase. In that year there were registered 362,744 births, or 41·21 per 1,000, and in 1885 the rate had increased on the same population to 45·36 per 1,000 It appears necessary to call attention to the fact, but we have no means of arriving at the exact truth.

3. The following have been the deaths registered during the last five years :—

Years.	Deaths.	Deaths per 1,000.
1881	241,467	27·43
1882	263,863	29·98
1883	304,763	34·56
1884	240,714	27·30
1885	301,684	34·21

The death-rate for 1885 was thus 34·21 per 1,000, while the average rate for the preceding five years had been 30·11 per 1,000, marking an apparent increase above the average of 4·10 per 1,000 in 1885.

Divided between districts and towns the facts stand as follow:—District mortality in 1884, 34·48 per 1,000; previous five years' average, 30·57 per 1,000. Town mortality in 1885, 31·35 per 1,000, against a previous five years' average of 32·85 per 1,000. The towns have thus apparently improved in health, while the districts have deteriorated.

4. The lowest district death-rate was 22·26 in Sambulpur, and the highest 58·57 in Chindwara, the result of a great epidemic of fever, from which 12,912 people died, or 45·64 per 1,000 of the population. The town death-rates ranged between 11·51 per 1,000 in Sironcha and 54·81 per 1,000 in Murwara, but it seems doubtful whether the population (8,612) is not under-estimated in this latter case, as the previous five years' average was 51·54 per 1,000. Any way the case should be dealt with. The actual highest rate of the year was 59·85 per 1,000 out of 1,203 people in Charwa, but the numbers are too small to afford a reliable ratio.

5. We shall next discuss the death causes under the usual classification. In 1885 these were as follow :—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera	21,868	2·48
Small-pox	3,364	0·38
Fever	170,634	19·35
Bowel complaints	27,455	3·11
Injuries	4,936	0·56
All other causes	73,427	8·33
All causes	301,684	34·21

This abstract shows that 74 per cent. of the mortality of 1885 was due to diseases of the epidemic and endemic class, the fatality of which is known to be under the influence of local conditions and domestic habits. In these, as in other provinces of India, the sanitary problem to be dealt with is mainly how to reduce the amount and fatality of epidemic and endemic diseases.

6. Assuming that the population has been tolerably constant during the 10 years preceding 1885, the following abstract will enable some idea to be formed of the past history of cholera :—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1875	14,643	1880	330
1876	20,124	1881	9,140
1877	3,418	1882	11,932
1878	40,985	1883	16,235
1879	27,575	1884	149

As already has been stated, the deaths from cholera were 21,868 during the year under review, and when taken in connexion with the data in this table the past cholera history points to a considerable annual mortality, with single years of a large reduction in the number of deaths. This order of succession is partly due to the periodical invasion of the Central Provinces by epidemics of cholera, coming from Bengal and the North-West Provinces.

7. The epidemic of 1885 showed its presence in all the districts and in 118 registration circles out of 168; but deaths were reported from no more than 2,127 villages out of 27,765, showing the purely local character of the outbreaks. The deaths among the country population were 20,447, or in the

ratio of 2·54 per 1,000, and in the towns there were 1,421 deaths, or 1·88 per 1,000. Taken over the whole provinces the cholera death-rate of 1885 was 2·48 per 1,000, showing a large increase over the preceding five years' average, which was ·90 per 1,000. The year's mortality included several severe district epidemics. Thus, the death-rate in Murwara was 6·94 per 1,000. In Bilaspur the rate was 5·46, and in Raipur 7·70 per 1,000. The apparently low town death-rate of 1·88 was due solely to the fact that 35 out of the 73 towns were free from the disease. Many of the attacked towns yielded very high rates, and as such instances afford a clue to the places where special sanitary investigation and work are required we may cite them. Murwara, 15·21 per 1,000; Charwa, 14·13; Mandla, 13·77; Maharajpur, 14·93; Raipur, 12·63; Drug, 20·54; Arung, 15·63; Rajim, 14·15; Bilaspur, 12·09; Mungeli, 18·08 per 1,000. Some of these towns have limited populations, approaching those of villages, and would afford excellent illustrations of village as well as of town local predisposing causes, and the effects on epidemic susceptibility of their removal.

8. The first death from the cholera epidemic of 1885 was reported on the 16th January, in a village in Hoshangabad district, and this was the only village from which deaths were reported in January. There were six deaths during the same month in this district, at the western end of the provinces. In February there were two deaths in Nimar district in the same Nerbudda division, but the first outbreak of the disease in its epidemic form took place at the eastern end of the provinces, in the Mahanadi division, and this occurrence is included in the following monthly table of cholera deaths:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	6	July	5,700
February	110	August	5,165
March	165	September	2,725
April	637	October	1,678
May	1,438	November	813
June	3,300	December	131

At first sight this table includes the data of a completed epidemic, but as a matter of fact the disease was most severe in the western and eastern divisions, where it first showed itself.

9. The following notes on the sanitary condition of affected places are of interest. The Sanitary Commissioner and the Civil Surgeon agree in stating that the sanitary condition of the attacked villages in *Saugor* district was "decidedly good in many respects." Cholera was present in three registration circles out of 10 in the district, which also included 1,840 villages, in only eight of which were there deaths, 23 in all, or ·04 per 1,000 of the population. The facts should be stated, but the intensity of cholera, which is an important factor in all such cases, may have been low in this part of the Central Provinces.

In *Damoh* district "the sanitary condition of many of the villages is reported as bad, and especially "the water-supply. . . . . Surface cleanliness very defective. No proper arrangements made "for retiring ground; wells not protected as they should be, and cattle-sheds in many places part of "the dwelling-houses." The cholera death-rate, which had been 1·15 per 1,000 on a five years' average, had risen to 1·27 in 1885.

Murwara town had a cholera death-rate of from 14 to 17½ per 1,000 on its changing population. "The sanitary condition of the town is in many respects far from satisfactory."

On the other hand the city of *Jubbulpore* has been "practically free of cholera for the last "10 years." On this comparative exemption the Civil Surgeon remarks as follows:—"Things used "not to be so; in all previous epidemics Jubbulpore town suffered its share," and he very properly gives the following cautious opinion on the reasons of exemption:—"If I might venture to hazard an "opinion on a subject where opinions are proverbially unsafe, it must be to connect this immunity "with the excellent conservancy arrangements of the town, strengthened during the last 2½ years by "the greatly improved water-supply." On this view the Sanitary Commissioner says that on inspecting the town he was much pleased with its sanitary condition; but he adds that the points requiring most attention were the drainage and private latrines. The statistical facts regarding this case were as follows:—Jubbulpore district, with a population of 442,533, registered 1,162 cholera deaths, or 2·63 per 1,000. All the registration circles returned deaths, and out of 1,798 villages 115 suffered. Cholera was thus present over Jubbulpore district in some degree of intensity.

Jubbulpore town itself has a population of 63,733, and the cantonment of 11,972. The town population yielded only five deaths from cholera, or ·08 per 1,000, and the cantonment escaped altogether. This case may be safely accepted as showing what may be done with the dense population of an Indian city in the way of protection from cholera. But it may be safely predicted that immunity will be continued only so long as close attention on the part of the municipality is directed not only to preserving the ground already gained but to extending it, for so long as the drainage and private latrines are defective it cannot be averred that the public health is free from danger.

10. Of villages attacked in the *Narsinghpur* district, 34 per cent. are stated to have been satisfactory in their sanitary aspect, 23 per cent. bad, and 43 per cent. very bad; the observed defects being the dangerous practice of throwing the dead into the river Nerbudda, or the burial of them in the ravines close to the village, both practices showing the absence of regulations for disposing of the dead, want of drainage, and absence of protection of wells.

11. The district of *Hoshangabad* had a cholera death-rate of 3·54 per 1,000. But the town of Hoshangabad had a rate of 1·26 per 1,000. The sanitary condition of the town is reported by the Sanitary Commissioner as "very good; it is carefully conserved, has most excellent and well managed " public latrines; the wells are not in all cases satisfactory, but are most carefully attended to; the " river is very largely used as the water-supply."

12. The next case is a pilgrimage case in *Nimar* district, where cholera existed between the months of February and September inclusive, and yielded a district death-rate of 2·58 per 1,000. While cholera was in the district there was a fair at Mandhata, where in April 119 deaths took place, 63 of which were among pilgrims, and it is stated that the first cases were among pilgrims who had the disease on them when they arrived. The place of pilgrimage is reported to have been " in a " very insanitary state, the lodging-houses crowded, and the heat excessive. . . . . The houses " are crowded together, so that ventilation is bad, and the banks of the river are largely " resorted to as retiring places, both above and below the town, the river being the chief water-" supply."

13. *Mandla* district yielded a cholera death-rate of 3·68 per 1,000, and the Civil Surgeon, who visited 28 of the cholera-attacked villages, reports that they " were all in a sad state of insanita-" tion, there was the usual litter outside, enclosures covered with rubbish, few bad wells, Nalas " gave the drinking water, and must have been polluted with all the washings of soiled clothes."

14. In a number of outbreaks the villages were inspected by the Civil Surgeons, and their sanitary defects were similar to those already stated, so that it is unnecessary to quote them. But there are two towns, Nagpur and Raipur, which appear to yield important experience. The former town has had an excellent water-supply for a number of years, and has undergone considerable improvements in other directions.

Nagpur district had a cholera death-rate of ·05 per 1,000, exactly the same rate as Nagpur town with its population of 98,299. This town had only five deaths from cholera; but it will be evident that the epidemic was not of a severe character in the district, for there were only 36 deaths. There was one choleraic case in Nagpur Central Jail, ill on admission, which recovered.

The experience of *Raipur* was very different. This district returned deaths from cholera in all its registration circles, and 653 villages suffered out of 3,095. The cholera mortality was represented by 8,794 deaths, or 7·70 per 1,000 of the population, against a previous five years' average of ·30. Cholera, as an epidemic, was thus greatly more severe in the Raipur district than it was in Nagpur. Raipur town, out of a population of 24,948, lost 315 people from cholera, or 12·63 per 1,000. The epidemic began in the district with 21 deaths in February, and up to the end of June 1,824 deaths had been registered. In this state of the epidemic cholera broke out in Raipur Central Jail, and in the course of three months there were 40 cases and 35 deaths out of an average daily population of 505, or a death-rate of nearly 70 per 1,000. No account is given of the conditions attendant on this great loss of life in the jail. The Chief Commissioner, however, ordered an inquiry to be made by the Sanitary Commissioner into the sanitary state of the villages in the Raipur and Bilaspur districts, and the following is a general account of the results:—"In the greater number of villages the " abridged village conservancy rules are practically set at nought. . . . . The water-supply is " especially defective in many villages. Tanks are almost everywhere in these districts the chief " source of drinking-water, but in very few is any attention paid to keeping the supply pure. In " almost all bathing is carried on in the tank set apart for drinking purposes, and in not a few " washing of clothes and watering of cattle are also permitted. The catchment area of many is not " clean. The custom of digging earth (with which to build or repair the walls of the house) from " within the enclosure round the house, instead of from a distance beyond the inhabited site, is very " common. The excavations are filled up with sweepings, &c. A large number of houses have " what may be called manure bins, being mud-walled enclosures (not unfrequently built on to the " mud wall of the house) in which manure, rubbish, &c. are collected and stored till the time " for spreading it over the fields comes round."

15. These brief details of local predisposing causes of cholera are of a kind long known all over India, but in the Central Provinces cholera partakes more of an endemic than of an epidemic character, moving about rather than over the country, and its fatality at any given place and time depends mainly on what may be called "epidemic intensity," but we know nothing of the causes of this characteristic. The practical result of the year's experience is that our hope of lessening the annual losses from cholera depends on continuous efforts towards the improvement of towns and villages.

16. *Small-pox.*—The following ratios abstracted from a table in the Report give the statistics of small-pox for a period of 15 years:—

Years.	Small-pox Deaths per 1,000.	Years.	Small-pox Deaths per 1,000.
1871	·20	1879	3·44
1872	·57	1880	·69
1873	1·37	1881	·21
1874	2·38	1882	·45
1875	2·78	1883	·53
1876	·51	1884	·55
1877	·37	1885	·38
1878	2·18		

This table shows traces of two small-pox epidemics, and it is satisfactory to see that of late years the disease has decreased in fatality.

17. The disease was more or less prevalent in all the districts, with the single exception of Nimar. Deaths from it were registered in 131 circles out of 168, and 1,260 villages out of 27,765 reported deaths. During the year 1885 there were 3,364 deaths, or ·38 per 1,000, against a preceding five years' average of ·49 per 1,000. It is worthy of notice that of the 3,364 deaths there were 1,393 at ages under one year, showing defect in vaccination at the earlier ages. The monthly mortality was as follows :—

Months.	Deaths from Small-pox.	Months.	Deaths from Small-pox.
January	312	July	339
February	353	August	198
March	376	September	87
April	479	October	67
May	482	November	88
June	453	December	130

As usually happens, the warm months were those of highest mortality.

Of the total deaths 3,023, or ·37 per 1,000, took place among the country population, and 341, or ·45 per 1,000, in the towns, of which 37 yielded deaths and 36 escaped the disease.

18. In the course of the last five years there had been 1,761,893 vaccinations performed, yielding a rate of 188·76, while the average death-rate had been 2·12 per 1,000. We may add the actual number of small-pox deaths registered during the last 10 years as follows :—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1875	20,226	1880	5,184
1876	3,819	1881	1,816
1877	2,768	1882	3,915
1878	16,151	1883	4,696
1879	25,492	1884	4,882

These numbers, with the addition of 3,364 deaths in 1885, will show the course of the disease perhaps more clearly than the ratios already given.

19. *Fevers.*—Under this head we shall first give the registered deaths assigned to fevers for the past 10 years :—

Years.	Fever Deaths.	Years.	Fever Deaths.
1875	120,480	1880	136,840
1876	149,786	1881	143,933
1877	131,123	1882	152,407
1878	218,577	1883	175,119
1879	135,933	1884	145,342

The great mortality in 1878 was coexistent with the famine and scarcity of the time. During the last five years the death-rate from fever was 18·31. During the year 1885 there were 170,634 deaths from fever registered, and the death-ratio was raised to 19·35 per 1,000.

20. During the year under review deaths from this cause were returned from all the 168 registration circles, and out of 27,765 villages fever deaths were returned from 21,638. Probably no village population escaped fever attacks. Fever was universally prevalent. All the 73 towns suffered and yielded 9,297 deaths, or in the ratio of 12·28 per 1,000 of their population. The rural deaths were 161,337 in number, and reached 20·02 per 1,000 during the year, which means that one person in every 50 died of fever. Sambalpur, as usually happens, returned a fever-rate of only 6·08 per 1,000, while in two districts, Chindwara and Seoni, the ratios were not less than 45·64 and 46·96 per 1,000. In the town of Seoni itself the rate exceeded 3 per cent. These figures are, of course, liable to considerable corrections from errors in diagnosis, but as these errors are not likely to vary much, the actual recorded numbers may be used in the way of comparison.

21. The next abstract gives the fever deaths month by month for 1885 :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	8,520	July	12,747
February	8,745	August	18,425
March	9,710	September	20,412
April	10,370	October	20,349
May	11,970	November	20,909
June	10,857	December	18,520

These data show the usual course of fevers, namely, increase during the heat and rains, followed by a much larger fatality during the drying and variable temperature months.

22. The most frequent type of fatal fever cases was remittent fever. There were cases of intermittent also, but well marked intermissions were not frequent. Several Civil Surgeons investigated the causes of death in their localities and villages, and the following abstract gives the result of five reports :—

Causes of Death.	Total Deaths.
Fevers	1,503
Bowel complaints	367
Chest diseases	319
All other causes	2,083
All causes	4,272

If these numbers can be taken as representing fair averages for the provinces, we should have 35 per cent. of the total deaths of the year due to fevers, as against 56 per cent., which is the proportion of fever deaths to the total mortality assigned by the registration returns.

23. The report contains no account of the fever causes, but there is no reason to doubt that the local conditions connected with damped undrained village sites and houses, and insanitary conditions in houses and compounds, do not differ materially from those usually prevailing, and that a remedy against fever mortality must be sought in general village and town improvements.

24. *Bowel complaints.*—The next abstract gives the deaths from this disease group for a period of 10 years:—

Years.	Bowel Complaint Deaths.	Years.	Bowel Complaint Deaths.
1875	15,562	1880	19,205
1876	19,952	1881	22,133
1877	14,867	1882	24.639
1878	26,098	1883	26,623
1879	19,747	1884	21,991

The year 1878 was the famine and scarcity year, and even including this exceptional year in the comparison, it will be seen that the bowel complaint deaths have materially increased during the last quinquennial period. In 1885 the deaths assigned to this cause were 27,455, or 3·11 per 1,000, and the previous five years' average was 2·78 per 1,000. These death-causes were generally prevalent in 1885, for all the 168 registration circles returned deaths, as did also 8,360 villages out of 27,765, or 30 per cent. of their number.

25. The highest death-rate of the year was, as usually happens, returned by Sambalpur. It amounted to 9·31 per 1,000, but it was below the usual five years' average, which was 11·49 per 1,000. In consequence of persistency in the high rate, several attempts have been made at different times to arrive at the causes, and in the present Report it is stated that the *post-mortem* appearances were investigated by the Civil Surgeon with the result that "dysentery is extremely prevalent." This being the case, it is highly probable that bad water may be a cause of the dysenteric cases. At all events the quality of the water ought to be examined on the facts as they stand, and means taken to improve the supply if necessary.

26. The monthly incidence of bowel complaint mortality was as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,185	July	2,627
February	1,249	August	4,044
March	1,306	September	4,020
April	1,537	October	3,359
May	1,648	November	2,599
June	1,849	December	2,032

These figures appear to show that climatic causes bear a part in raising the death-rate from bowel diseases, and they render it not improbable that some fatal cases of dysentery may be secondary results of fever.

27. *Injuries and all other causes.*—Under the former head were registered 4,507 deaths, chiefly from wounds and accidents, suicides, and wild beasts. Under the latter head there were grouped 63,282 deaths. Neither of the classes requires remark.

28. *Sanitary works (Civil).*—The following statement regarding the sanitary progress of 1885 is given by the Sanitary Commissioner:—"The district sanitary reports do not mention any special "work as having been executed, but show that attention was paid to the improvement of the water "supply, by the improvement of the existing and the digging of new wells and tanks, and at "Nagpur, Hinganghat, and Burhanpur, by the extension of the pipes; that drainage has been "improved and extended, and that conservancy has been improved by (in many places) a better style "of latrine, increase of establishment, and better arrangements for the disposal of the night-soil."

29. The following shows the present state of the village water-supply and the improvements carried out in the course of the year:—

Total villages in provinces - - - -	27,765
Number drawing water from pucka wells - - -	4,640
„ „ kutcha wells - - -	5,799
„ „ tanks only - - -	4,502
„ „ streams only - -	5,135
From streams ceasing in hot weather - - -	3,227
Water notoriously bad or deficient - - - -	273

The number of wells repaired or constructed in 1885 was as follows:—

Number of villages where improvements were effected - -	202
Improvements in pucka wells - - - -	6
„ in kutcha wells - - - - -	4
New wells constructed:	
Pucka wells - - - - -	110
Kutcha wells - - - - - - -	120

The contribution to water improvement of villages for one year, 1885, was thus represented by 10 wells improved, and 130 constructed. There are no data to show the actual sanitary state of the village water-supply at the present time; but well improvements and constructions have been slowly pursued for many years past.

30. Of the total outlay in the 13 districts, the following were the sums expended on purely sanitary work:—

	Rs.
Conservancy - - - - -	1,17,242
Drainage - - - - -	3,664
Water-supply - - - - -	33,593
Total - - -	1,54,499

or about 15,000*l.*

31. *General remarks.*—Under this head are given a few details of town inspections made by the Sanitary Commissioner, which merely state the surface condition of the localities, the only aspect of the case with which the reporter could deal.

Of *Seoni-Malwa,* it is stated that there were public latrines in good order, but little used. Surface cleanliness bad except in public places; private latrines not well kept. Old drains deep and difficult to clean. House drainage very defective. State of river very insanitary, with stagnant pools here and there dug for brick-making. Water from wells. Repairs and drainage of wells required.

Hoshangabad.—Surface conservancy good. House drainage insufficient. Holes requiring filling up. Water largely from the Nerbudda. Well improvements necessary. The sanitary conditions in *Sohagpur, Gadarwara,* and *Garhakota* nearly the same.

Saugor.—Latrine arrangements badly managed; surface cleanliness fair, but there are many ruined houses which harbour impurities. These exist in most eastern towns, and the spaces require filling up and levelling, with fencing off until the spaces are used. The drainage arrangements are very defective, and there are many holes outside houses into which the house drainage collects and soaks into the ground, besides some very large masonry cesspits. Water-supply requires to be amended.

With the exception of the sanitary notes on cholera affected villages already given, there is no account of these population groups, neither is there any abstract of the Civil Surgeon's reports, which the Sanitary Commissioner states "must be brief and convey but little information."

32. Since sanitary measures were first initiated in the Central Provinces, much work of one kind or another has been done, the first step taken having been to improve the water-supply. So far as several of the towns are concerned, this mode of proceeding has led to good results, because in these cases, water sources have been selected beyond the reach of town impurities. It is very doubtful, however, if improved wells in villages have led to equally satisfactory results, because any water drawn from a foul subsoil necessarily carries with it the character of its source. It hence follows that, unless new village wells are dug in clean subsoils, and at a distance from all village impurities, confidence could scarcely be given to any number of new or improved wells as indicative of local sanitary improvements in villages. It appears necessary to make these remarks in the face of even the limited amount of information on the sanitary state of villages and village sites which the Report contains; and even such as it is, the facts stated would be sufficient to point to a condition of matters

in the highest degree likely to lead to severe outbreaks of epidemic and endemic diseases. The sanitary condition of village communities is the result not of any one defect, but on the contrary each village case, and it may be added each town case, presents its own sanitary problem, the essential elements of which must be disentangled and dealt with as a whole, and not any single one of them selected for treatment. We would give every credit for the work already done in a number of the towns, but looked at from this point of view, the town experience has been mainly important in showing what it is possible to do by the intelligent application of sanitary principles in certain directions; but in several others of equal importance there is ample room for improvement in the abolition of cesspits, the introduction of house drainage as an essential element in completing the water-supply, and in general town improvements.

We are desirous, nevertheless, of directing attention to the sanitary improvements introduced at Jubbulpore, Hoshangabad, and Nagpur, in which by the application of ordinary sanitary methods, the cholera death-rate has been reduced below the rate of the surrounding rural districts, affording in this matter examples which might be followed with advantage elsewhere.

As to the villages, it is evident enough that village rules have no self-executive power, while, so far as we can be guided by statistical history, little or no impression has yet been made on the predisposing epidemic death causes. It has thus to be considered whether better arrangements ought not to be introduced for the advance of sanitary work in these provinces. Their population is a comparatively small one, and the problems to be dealt with are, so far as we can judge, of smaller magnitude than those presented by other districts of India. But, nevertheless, their experience has been the same, and it all points to improved methods of dealing with Indian sanitary conditions as the only way of reducing these great epidemic death-rates.

28th April 1887.

No. 8.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1885.

1. The population furnishing registration returns in these districts is that of the 1881 census, which numbered 2,630,018. Of this population, 2,318,621 occupied 5,518 villages within the six districts, and 311,397 inhabited 34 towns.

2. The births registered in 1885 were of:—

Males	58,365
Females	54,416
Total	112,781

yielding a birth-rate for the Assigned Districts of 42·9 per 1,000. The lowest birth-rate of the year was 39·2 in Akola district, and the highest was 47·8 in Buldana.

In the towns the lowest birth-rate was 26·4 per 1,000 in Paratwada, and the highest 56·5 per 1,000 was returned from Sirasgaon. Many of the towns have limited populations, but if we select Amraoti with 25,828 inhabitants, and Ellichpur with 26,728, we find the birth-rate in the former 26·6, and in the latter 38·8 per 1,000. The Sanitary Commissioner has given a table of birth-rates for rural circles and towns for five years, which shows the rural rate to have averaged 43·4 per 1,000, and the town rate at 35·7 per 1,000. The corresponding rates in 1885 were for the country 43·3, and for the towns 40·8 per 1,000. At first sight it would appear that the towns where the facts were more likely to be correctly arrived at, yielded rates nearer the true rate than did the country circles. In a former memorandum we called in question these birth-rates, and suggested inquiry, and in the present Report the whole subject of birth registration is fully discussed, and some detailed data are given for six villages with an aggregate population of 3,142 on the 1881 census. On house to house inquiry, it was found that the resident population amounted to 3,054, and that there had been registered 124 births in 1885, yielding on the census population a birth-rate of 39·4 per 1,000. But the number of births returned by the special inquiry was 140, and this number gives a birth-rate on the *resident* population of 45·8 per 1,000. The numbers examined, although of little use in deducing a birth ratio for the provinces, present, nevertheless, some remarkable results, but it would scarcely be justifiable to draw from them the conclusion that the birth-rate in India normally exceeds that of England and Wales by about 9 per 1,000. The Sanitary Commissioner adheres to his opinion as to the approximate value of the birth-rate, and it is just possible that the high death-rate has something to do with this. He says, what is generally believed in Europe, "the highest "birth-rates occur in crowded cities, amongst the poorest and unhealthiest classes, and that they "generally coincide with high death-rates."

We shall leave this discussion for the present, in the hope that the difficulties surrounding it may be solved by better registration.

3. *Deaths.*—As there is some doubt on the accuracy of the statistical ratios, we shall place in the next abstract the number of deaths registered alongside the death-rates for a period of 18 years:—

Years.	Registered Deaths.	Ratios per 1,000 of Population.	Years.	Registered Deaths.	Ratios per 1,000 of Population.
1868	36,144	19·1	1877	61,459	28·1
1869	47,338	22·8	1878	178,404	81·5
1870	53,872	24·6	1879	51,907	23·7
1871	38,725	17·7	1880	51,725	23·6
1872	81,108	37·1	1881	76,661	29·1
1873	49,896	22·8	1882	77,214	29·4
1874	60,797	27·9	1883	135,081	51·3
1875	88,068	40·3	1884	64,808	24·6
1876	69,832	31·9	1885	89,558	34·0

This table shows the advance in registration during the earlier years; and considerable annual variation in the public health, or in the registration. It shows also the great loss of life during the famine year 1878, together with the increased mortality of 1885, but it cannot be said that the figures afford evidence that the public health in these districts has improved during the 18 years.

4. When compared with the average death-rates of the previous five years, the district rate of 1885 was 33·7 per 1,000 against a previous five years' average of 26·5. The town rate was 36·6 per 1,000 in 1885, but we have not the previous five years' rate. For the whole population the death-rate in 1885 was 34 per 1,000 against a previous five years' rate of 30·8 per 1,000. It cannot be said that these figures augur favourably for the health of these Assigned Districts at the present time.

5. The next abstract shows the district death-rates separately in comparison with the five years average.

Districts.	Deaths per 1,000 in Districts.		Death-rates per 1,000 in District Towns in 1885.
	1885.	Previous 5 Years' Average.	
Amraoti	34·6	31·7	31·8
Ellichpur	39·6	35·1	34·2
Wun	25·1	25·7	30·3
Basim	29·9	28·0	34·6
Akola	35·5	34·1	41·3
Buldana	38·7	30·4	43·8
Average	33·7	26·5	36·3

With the single exception of Wun, the death-rates in all the districts exceeded those of the five years by 7 per 1,000.

The town death-rates generally are very high, a number being between 4 and 5 per cent., and nearly all show considerable increase over the previous five years' average.

6. *Causes of deaths.*—We shall next see what information the Report affords us on the causes of these high death-rates, and with this object we shall abstract the following statement:—

Causes of Death.	Total Deaths Registered.	Deaths per 1,000 of Population.
Cholera	3,683	1·4
Small-pox	259	0·9
Fevers	37,339	14·1
Bowel complaints	15,785	6·0
Injuries	1,060	0·4
All other causes	31,432	12·0
All causes	89,558	34·8

7. The deaths from *cholera* in 1885 were 3,683 in number, and in order to show the relation of this fact to the past cholera history of these districts we may abstract the following annual deaths for the preceding 17 years, with those of 1885 :—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1868	5,447	1877	842
1869	10,947	1878	34,306
1870	504	1879	223
1871	581	1880	1
1872	1,578	1881	3,404
1873	—	1882	3,573
1874	2	1883	27,897
1875	22,465	1884	87
1876	2,683	1885	3,683

It will be seen that cholera in Berar is liable to break out suddenly in great intensity, and to subside as quickly as it appeared.

8. In 1885 there were deaths from it in every month except in April, and the following abstract shows the year's history of the epidemic :—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January	8	July	261
February	6	August	1,075
March	1	September	1,395
April	—	October	488
May	49	November	152
June	233	December	15

These monthly figures repeat very closely the usual progress of epidemic cholera in the Berars. In some years there is an apparent increase with increase of rain, while in others the heaviest rainfall precedes the decline of cholera.

9. The disease existed in greater or less severity in all the districts, and out of 119 circles of registration, 82 returned deaths. There are 5,518 villages in these districts, of which 390 were attacked, and the remainder escaped. Distributed among the affected villages, the deaths would yield 9·4 per village. Of the 34 towns, 17 were attacked, and registered 674 deaths, or 2· per 1,000 of the total town population. But, as usually happens, the mortality was much greater in some towns than in others. Balapur, for example, had a death-rate of 7·7, Barsi Takli of 9·1, Akola of 10·1, and Pusad of 11·5 per 1,000, ratios which show a high degree of epidemic susceptibility among the people. The highest district death-rate, 2·2 per 1,000, was returned by Buldana. The average rate for the whole population was 1·4 per 1,000, against a previous five years' ratio of 2·7, or nearly double. The year 1885 was thus a year of cholera decline. The total number of persons attacked in the course of the year was 8,529, and the deaths were 43·2 per cent. of the attacks.

10. A number of details bearing on the spread of cholera are given in the local reports, which contain less theoretical matter than usual; but still the question with some minds appears to be how cholera was brought to a given locality, rather than why it was there, which latter is the sanitary question requiring reply. The Sanitary Commissioner himself is by no means disposed to take up the importation theory, as the following case will show. The Civil Surgeon who reports it, after stating that no sanitary defects other than those which he observed elsewhere existed in the village houses, sums up the case as follows:—"Two men go to different places where cholera is, return and "are attacked and die of the disease, cholera. The people in their houses are attacked with the "disease, cholera. No speciality of any kind marks their habits nor their habitations from the other "people and their dwellings in the village. The deduction that cholera is propagated by contagion "is inevitable." The defect in cases so stated is that only certain facts are brought into account, and all other facts are left out. The Sanitary Commissioner in his comment on the case, says:— "Considering that at the time of the appearance of the disease at Sanjapuri, cholera was at its "height in the district and throughout the province generally, and that the disease moreover, was "prevailing in 12 villages of the Murtazapur circle, the first in the district to be attacked, it is "almost needless to seek to establish importation, the area itself within which the village was "situated being an infected one." This village contains 150 houses, and about 650 people. The first cholera case in it took place on the 6th September, and died on the 8th, and there were in all nine cases and three deaths in the village. But the statistics show that in the preceding month, August, there were in the village two deaths from bowel complaints, while in Murtazapur circle, within which the village of Sanjapuri is situated, cholera prevailed between the 23rd May and the 22nd October 1885, and in 10 of its villages 59 people died of cholera. The foundation for importation in this case is so slender that it scarcely demands notice, were it not that opinions of this kind have a direct tendency to divert attention from the real facts and necessities of the case. The Civil Surgeon tells us that "the village itself was in a satisfactory state as regards conservancy, water-"supply, and drainage, for there appeared no lodgment of water save a large dirty pool to the west "of the village." It is sufficient to show how imperfect this sanitary report is, to point out that there is no account of the water supply except an opinion, that the absence of water lodgment is no proof of good subsoil drainage and clean subsoil, and that mere surface cleanliness is no security for that state of purity of air, earth, and water which is required for safety during epidemics.

11. The correction for this Sanjapuri case is afforded by what happened in the village of Signapur in East Ellichpur circle, where three people were attacked and two died of cholera. The cases had had communication with a village where there was cholera. They suffered in consequence, but no others were attacked. "It is evident," as the Sanitary Commissioner remarks, "that other influences "besides infection are necessary to set up a cholera epidemic."

12. Another interesting village case is mentioned in which 15 people were attacked, and five died of what appeared to be cholera. The first case presented itself on the 9th February, and the last on the 11th. When the first case was attacked, a large number of relatives and friends came to see the patient, bringing with them their food, which was put into a dirty brass pot encrusted with verdigris. Most were taken ill while eating, some with vomiting, others with purging, and others again with both. Suppression of urine generally absent, but there was pain, and cramps were generally present. In the village, Sirsagaon, where these cases took place, there was no diarrhœal disease, and nobody else suffered. Cholera was in the country, and the symptoms in the affected cases were something more than those due solely to copper poisoning. Still it may be asked, did not this poisoning act as an effective predisposing cause, in the same way as over high game and other similar articles of food have acted during cholera epidemics? The Civil Surgeon who conducted the inquiry says, "I am of opinion that Poonjia's case (the first one) was due either to dirt or poison "(verdigris) from dirty utensils acting on disordered bowels." As to the condition of the village, he says, "The sanitary state of the village is very bad (worse than most Native villages). Stagnant "water in every street, cow dung and kutchra lying about. Water-supply from wells and river; "drainage deficient."

13. These are the principal cases requiring notice in the cholera history of 1885. In other respects the state of villages and towns appears to have presented the usual insanitary conditions of epidemic localities; keeping cattle and manure heaps within villages and house compounds, want of cleansing, and doubtful water-sources were the most common local insanitary conditions observed, and the facts suggest the remedies.

14. Cholera in *Akola* town presented some features of interest which suggest points for future inquiry. It appeared in scattered unconnected cases, but in its epidemic form, its attacks were concentrated among an irregular group of huts on the east bank of the river, where a great deal of refuse matter was lying about; otherwise the sanitary condition of the town is stated by the Civil Surgeon to have been "good," with one apparent exception, to be presently noticed. Akola suffered very severely from epidemic cholera, and its death-rate from the disease was no less than 10·2 per 1,000 of the population, while the death-rate of the district within which the town is situated was 1·7 per 1,000, and the ratio for the whole province was 1·4. Now in 1883 the cholera death-rate of Akola town was 2 per 1,000, while the district rate was 9·7, and the provincial rate was 10·6 per 1,000. Is there any condition which would account for these great differences in the town death-rates? The account given by the Sanitary Commissioner is as follows:—"The only exceptional "measure taken in 1883 was the prohibition of the river water for drinking and domestic purposes, "and whether to this should be attributed the limited prevalence of cholera in 1883, or whether it "was a mere coincidence that the intensity of the epidemic should fall more lightly on Akola than "on the district and on the province generally, it is impossible to prove, but the fact remains that "for a series of years since 1868, cholera mortality in the town of Akola has always been in excess "of the district-rate up to 1883, when the use of the river-water was prohibited," and the practical result is arrived at that the use of the river-water for domestic purposes should be prevented during future epidemics. This was not done in 1885, and the cholera death-rate, as we have seen, was 10·2 of the town populalion. We may remark on this case that one year's data would scarcely warrant us in deciding against the use of river-water. In the first place, it is one of the unexplained properties of cholera that it may leave towns and districts within epidemic areas almost free for years, and nevertheless it may swoop down on them without warning, and cause great loss of life. In the next place, before it could be said that any water-source is too impure for safe use during cholera seasons, it would have to be shown by analysis to be so. Again, the history given by the Civil Surgeons of the locality where cholera established itself might justify the conclusion apparently that the surrounding insanitary conditions of the people who suffered, including the state of the river-margin where they obtained their water-supply, might have acted as localising causes of this severe outbreak. One conclusion appears to be justified by the results, and this is that, whatever may be the external appearance of this town, the epidemic of 1885 has warned the authorities distinctly enough not to trust to appearances for safety, but to go to the root of the matter and to discover and remove the subsoil causes as well as the surface causes of epidemic predisposition of the people. This is the problem which the cholera of 1885 has left behind it for solution.

15. *Small-pox.*—The following abstract gives the registered small-pox mortality in these districts for a period of 18 years:—

Years.	Deaths from Small-pox.	Years.	Deaths from Small-pox.
1868	3,496	1877	6,380
1869	6,365	1878	5,850
1870	1,394	1879	71
1871	601	1880	39
1872	8,369	1881	225
1873	8,326	1882	369
1874	1,112	1883	3,853
1875	927	1884	615
1876	415	1885	259

The first deduction from this table is that during the last nine years the deaths from small-pox in these districts have fallen to nearly one half of the previous nine years' numbers; that since 1878 this disease has ceased to assume a distinctly epidemic character; but that its characteristic during the whole period has been that of sudden increase and subsidence.

16. The 259 deaths in 1885 represented a death-rate of ·09 per 1,000 against a previous five years' average of ·4 per 1,000. Of these deaths the district population yielded 227, or ·09 per 1,000, and the towns 32, or ·1 per 1,000. The disease appeared in 10 towns out of 34, but it was present in all the districts. As usually happens, however, its attacks were purely local, for out of 119 circles of registration, only 43 returned deaths, and out of 5,518 villages all escaped except 70.

17. The monthly registered deaths were as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	20	July	15
February	20	August	6
March	38	September	3
April	61	October	1
May	40	November	5
June	34	December	16

The hot months yielded the most of the mortality. The deaths were so few that no general deductions can be drawn from the facts. The vaccination report was to be drawn up for the official year, and it is not in the sanitary report. The sooner this departure from all sound statistical principle is arrested, the better will it be for the public service. How any one acquainted with the elementary principles of vital statistics could have introduced such a system of record, appears to require explanation.

18. The Sanitary Commissioner has given the following comparison for five years' periods between vaccination and small-pox, which may be quoted in abstract :—

Periods.	Ratio per 1,000 successfully vaccinated.	Ratio per 1,000 Small-pox Deaths.
1868–72	8·92	2·02
1873–77	25·72	1·56
1878–82	31·2	·58
1883–84–85	35·	·59

In 18 years about a tenth of the population has been successfully vaccinated, and 4·75 per 1,000 have died of small-pox. The amount of protection appears small for the result.

19. *Fevers.*—This disease heading presents the usual difficulty that under it are classed most, if not all, fatal cases attended by febrile symptoms. But in the present case an attempt has been made to separate deaths really due to fever from the general confusion, and with the following result. We shall first give the deaths as entered on the registers. In eight villages in Wun district there were registered a part of 201 deaths under the following heads :—

	Deaths.
Fever	138
Cholera	23
Accidents	2
Dysentery and diarrhœa	7
Cough	1
	171

The fever-deaths were 68 per cent. of the total deaths registered. Two of the eight villages were next selected, and a detailed inquiry into the nature of the fatal diseases was carried out. There were in all 26 deaths entered on the register, all under the head of fevers. An inquiry into the nature of the fatal cases led to the following improved classification :—

	Deaths.
Cholera	3
Fever	8
Worms	2
Asthma	4
Puerperal disease	3
Old age	1
Atrophy	2
Pneumonia	1
Infantile deaths	2
Total	26

The fever-deaths were in the ratio of 30·8 per cent. of the total deaths. Of course no general rule can be formulated on numbers so small as these, but when we find the ratio of fever-deaths to the total mortality reduced by simple technical medical inquiry from 68 to 30·8 per cent., it appears to warrant a recommendation that Civil Surgeons might possibly in the course of time help us to a real knowledge of the actual amount of fever mortality by a not very laborious investigation. Enough has been done in these and similar cases to show that village diagnosis in fever cases is quite untrustworthy, and yet we have no resource but to proceed on the historical facts as they are stated in the Sanitary Commissioner's Report, and these are as follows :—

Years.	Total Deaths from Fever.	Ratio per 1,000.	Years.	Total Deaths from Fever.	Ratio per 1,000.
1868	10,936	5·2	1877	34,453	15·8
1869	12,917	6·2	1878	85,260	38·9
1870	23,023	10·5	1879	32,475	14·8
1871	18,125	8·3	1880	31,027	14·2
1872	31,853	14·5	1881	41,681	15·8
1873	19,242	8·8	1882	39,340	15·0
1874	26,732	12·2	1883	53,593	20·3
1875	26,076	11·9	1884	30,551	11·6
1876	39,875	18·2	1885	37,339	14·1

20. All that can be said absolutely of this table is that the number of deaths preceded by febrile symptoms has varied greatly in different years: but on the other hand, we have the enormous fever losses of life during the famine and scarcity years which corresponded to the fever losses in other Indian Governments, and we now know that in India malarial fevers are very fatal during and after famine. It is not improbable, in the case as it stands, that there may be a tolerably constant diagnostic error, and the real teaching of this abstract is to show how important it would be to sanitary work to call in the aid of the Civil Surgeons as we have already suggested. What we want is an approximate annual ratio of fever-deaths to the population, and to the total deaths registered, together with some account of the nature of the fevers.

21. We shall next discuss the fever statistics of 1885. There were, as we have seen, 37,339 deaths, or 14·1 per 1,000 of the population, registered under the head of "fevers." All the country districts and all the towns returned them. The district fever-rate was 14·2 per 1,000, and the town rate was 13·9. As we may suppose that diagnosis is better attainable in towns under local authorities than in country villages, we are here met by the fact that there is really no great difference in the deaths assigned to fever in the two groups. Any way this circumstance shows the greater need for inquiry.

22. In 1885 fever-deaths were returned from all the 119 registration circles, and from 2,096 villages, out of 5,518, in the province. Where the disease was so universally present, the question naturally suggests itself, were there no fever deaths, or no deaths where febrile symptoms preceded death, in the 3,422 villages which returned none? Whatever view we may take of the diagnostic difficulty, there are evidently very important questions which still require examination.

23. The next table copied from the Sanitary Commissioner's Report shows the relation of fever mortality to the monthly elements of climate.

Months.	Mean Temperature.			Rain.	Fever Deaths.
	Maximum.	Minimum.	Range.		
	°	°	°	In.	
January	83·0	59·5	23·5	—	1,843
February	84·7	56·5	28·2	·21	2,050
March	96·2	67·4	28·7	·29	2,310
April	100·8	73·5	27·3	·49	2,373
May	103·0	77·5	25·5	·64	2,246
June	96·6	76·0	20·6	4·82	2,010
July	87·8	73·0	14·8	10·28	2,309
August	85·3	71·4	13·9	4·83	4,028
September	88·4	71·3	17·1	3·54	5,428
October	89·4	67·7	21·7	2·35	4,762
November	85·2	60·1	25·0	·54	4,061
December	78·1	56·6	21·4	5·44	3,919

The table shows great increase of fever mortality after heavy rain, with falling temperature, even when the daily range had diminished. The conditions are those usually accompanying increase of fever in India. They are the atmospheric conditions which act on local causes and personal habits.

24. The lowest district fever-rate was that returned from Basim. It was 9·8 per 1,000 against a previous five years' rate of 8·5, but in several villages of this district an examination of the register showed 85 per cent. of the deaths placed under the head of "other causes." It appears that this is a favourite heading under which all deaths the village-writer cannot satisfy himself about are placed. Wun district returned the highest fever death-rate of the year, 16·7 per 1,000, against a previous five years' average of 18·8 per 1,000. There were a few towns in which the fever-rate was as low

or even lower than the district rate in Basim, but in most of the towns the losses from "fevers" were very great, reaching in the case of one town, Jamod, to no less than 28·5 per 1,000.

The Report contains no account of the local causes of "fevers."

25. *Bowel Complaints.*—The following have been the annual registered deaths from bowel complaints, chiefly diarrhœa and dysentery, for a period of 18 years :—

Years.	Bowel Complaint Deaths.	Years.	Bowel Complaint Deaths.
1868	5,489	1877	10,543
1869	6,154	1878	27,577
1870	14,312	1879	8,519
1871	9,284	1880	7,997
1872	21,961	1881	11,951
1873	11,112	1882	13,546
1874	18,603	1883	19,044
1875	20,818	1884	9,319
1876	16,388	1885	15,785

The year of greatest mortality was again the famine year 1878, but leaving out that year there is little appearance of any diminution of the deaths registered under this head during the whole 18 years.

26. Bowel complaints prevailed extensively over the Assigned Districts in 1885. All the circles of registration returned deaths from them, and, out of 5,518 villages, 2,696 were affected. The district death-rate was 6 per 1,000; but when we learn that in Wun district the registered death-rate was 1·3, and in Ellichpur 11·9, or tenfold, some inquiry is suggested by the facts. The town death-rate was 6·3 per 1,000, and this rate includes a ratio of 1 per 1,000 for Shegaon at an extremity of the scale, and 22·8 per 1,000 in Wadegaon at the other. The death-rate in Ellichpur town was 7 per 1,000, while the district rate was 11·9, as already stated. The death-rate for the whole population was 6 per 1,000 and the preceding five years mean was 4·7.

27. Past records of bowel complaint mortality show that these diseases are most prevalent and fatal during the latter half of the year, and, as will be seen in this abstract, the rule held good in 1885.

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	569	July	1,130
February	538	August	2,456
March	592	September	3,338
April	669	October	2,419
May	631	November	1,518
June	723	December	1,202

It is evident from these figures that climate influences the extent to which dysentery and diarrhœa prevail, while the greatly different death-rates in different districts and towns point apparently to the presence of active local predisposing causes.

28. *Injuries.*—Deaths from injuries were registered under the following heads:—

Suicides	230
Wounding	43
Accidents	575
Snake-bite and wild beasts	212
Total	1,060

The death-rate was ·4 per 1,000.

29. Unclassified deaths under the head of *all other causes* numbered 31,432, or 12·6 per 1,000, out of the total annual rate of 34 per 1,000.

30. *Jails.*—There are five jails in the Assigned Districts, one in each. Their available space is considered to be sufficient for 1,345 prisoners. The actual numbers were under the available space in all the jails, and the aggregate average of prisoners was a fraction over 1,045. But, nevertheless, the jails were liable to temporary overcrowding. Thus, in the four smaller jails, the aggregate accommodation in which was estimated at 281, the largest number in jail on any one day was 326. In two of these smaller jails there were no deaths; but in two others, Wun and Buldana, the death-rates were respectively 47 and 33 per 1,000; but the actual numbers in occupation at the most were 128, so that the death-rates may have been accidental. The total prison rate of the year was 19 per 1,000, of which the two largest jails of Amraoti and Akola, whose highest maxima gave 933 prisoners in space considered sufficient for 1,061, had death-rates, the former of 16, and the latter of 21 per 1,000. The average rate of 19 per 1,000 cannot be considered exorbitant for Indian jails in unhealthy localities, but the facts should be noted.

31. *Sanitary Works (Civil).*—There are seven municipalities in the province, and in all of them some work has been done in the course of years. Hence we may safely apply the statistical test to estimate the results to the public health in this abstract, showing deaths per 1,000 for 10 years.

Years.	Amraoti.	Ellichpur.	Basim.	Akola.	Kamgaon.	Shegaon.	Akot.
1876	28·1	55·2	37·8	39·7	27·2	39·2	39·1
1877	22·1	30·4	40·4	45·5	49·7	51·4	40·5
1878	38·7	78·9	110·7	107·9	100·2	117·8	84·5
1879	12·4	26·8	27·1	32·7	33·4	33·4	30·2
1880	10·3	27·8	26·2	30·4	28·6	38·5	25·4
1881	21·5	29·9	19·9	39·3	31·6	28·6	29·8
1882	29·5	26·5	20·7	35·9	22·	34·7	37·6
1883	44·2	69·2	37·1	36·9	33·1	59·1	75·8
1884	25·4	24·8	20·2	17·6	22·5	29·7	28·9
1885	28·3	35·3	30·5	36·4	39·1	36·4	57·9

This table shows traces of variable registration, and the enormous death-rates in these municipal towns in 1878 were due to the added famine deaths of that year; but, leaving these matters aside, we may ask the question whether the mortality of each succeeding year shows traces of the results of sanitary work? This question cannot be answered in the affirmative from the recorded facts. These municipal towns are still epidemic localities, and it may be safely concluded that whatever sanitary work may have been done has not as yet touched the localizing conditions of these diseases.

32. During the year 1885, out of a total death-rate in the 34 towns, including the seven municipal towns, of 36·6 per 1,000, no less than 22·3 was due to epidemic and endemic diseases, which may be considered a fair average indication of the present state of sanitary work.

33. The seven municipal towns have an aggregate population of 120,352, and their aggregate income for all purposes was Rs. 1,72,812. Of this sum Rs. 62,904 was devoted to sanitary work, under the heads of conservancy, drainage, water-supply, and other sanitary purposes, or about a shilling a head of the population, and less than 8*d.* a head sufficed for a year's conservancy.

34. The sanitary notes on each municipal town contain some points of interest, and, as they show where the more active disease causes which still exist may possibly be found, we shall give a brief analysis of them.

35. *Amraoti Municipality* has a population of 25,828. Its death-rate in 1885 was 28·3 per 1,000, and the previous five years' average was 24 per 1,000. It lost 33 people from cholera, 232 from fevers, and 79 from bowel complaints. The drainage of this town was undergoing improvement, but the Sanitary Commissioner considers "the completion of the drainage system of Amraoti town " is a very urgent work," and he suggests raising of a loan for the purpose. The new water-supply tank had been completed, but did *not* hold water because of the peculiarities of the subsoil, which absorbs collected water for a few years until faults or fissures through which the water escapes become silted up. Defects of this kind are usually remedied elsewhere by puddling the tank with some impervious clay material. In the meantime the water-supply is from wells, "for the most part brackish" (which usually shows sewage pollution,) or from a small stream in a similar condition. There are numerous cesspits and badly kept latrines, and the conservancy arrangements are very defective. The town sweepings are sold for Rs. 500, and nightsoil trenches to the extent of 5½ acres had been cropped at a net profit of about Rs. 88. The slaughter-houses are described as being in an abominable state.

We have thus a town of above 25,000 inhabitants without efficient drainage, with bad or doubtful water, with cesspits among the houses, where there ought to be none, either pervious or impervious, with defective cleansing and foul slaughter-houses, a high death-rate, and the prevalence of epidemics. All this cannot be said to be the result of absolute neglect, for work has been and is being done, but it is of an imperfect kind, without plan apparently or consistent method of procedure.

36. *Akola Municipality.*—Population 16,614. This town had a death-rate in 1885 of 36·4 per 1,000 against a previous five years' average of 31·3 per 1,000. It had 169 deaths from cholera, 158 from fever, and 46 from bowel complaints, out of a total mortality of 606, so that out of every 36 deaths 22 were caused by epidemic and endemic diseases. In this town there is no drainage system. The municipality were trying to get a scheme, but it does not appear how they were to find it.

The water source "is polluted by the town drainage." Work had been done in conservancy, but cesspit privies are in use. There were in this town, in 1885, 348 cholera cases and 169 deaths. "The general health of Akola was unsatisfactory. . . . The imperfections of the sanitary " arrangements are not unknown to the members of the municipality, who have exerted themselves " to minimize the evil effects." Hence it appears that this town also requires to be improved on a well considered definite plan, just as towns everywhere must be dealt with.

37. *Basim Municipality.*—Basim has a population of 11,567. It death-rate in 1885 was 30·5 per 1,000, and its previous five years' rate 23·5. This town escaped cholera, but it had 90 deaths from fever and 33 from bowel complaints. This town has a good water-supply from tanks, but the town wells are brackish. The drainage is very defective, but conservancy has been improved, and private latrines are under municipal management. For this town also a scheme of drainage is required.

38. *Khamgaon Municipality.*—Population 12,390. Death-rate 39·1 against a previous five years' rate of 25·7 per 1,000. Among the year's deaths were 29 from cholera and 29 from bowel complaints, but the main death cause was fever, from which 216 deaths were registered, or nearly half the mortality. A considerable amount of sanitary work has apparently been carried out in this town. There had been in all 11,555 feet of stone surface drains laid in the town, "and it was "noted that cholera, which prevailed in September and October, avoided the well drained parts of "the town in a marked degree." Water is obtained "from wells which for the most part fail in "the hot weather, and from a stream which is open to pollution." It is hoped that the present may be the last record of this water-supply, for in the course of the year the Jamuna water scheme was completed, and the loan paid off. As this scheme shows what may be done in these small towns we shall quote what the Sanitary Commissioner says about it. "The tank was finished before the "commencement of the rains of 1885, and the water is to be laid on to the town from the "1st March (1886). Forty-five covered cisterns and 23 hydrants have been erected, and there "is no part of the town that will not be within easy reach of water." But filtering arrangements have not yet been provided. It will be interesting to see what effect this important improvement exercises on the public health. The conservancy appears to be in fair working order, and the sewage is successfully used as manure.

39. *Shegaon Municipality* has a population of 11,079. Its death-rate in 1885 was 36·4, and its previous five years' rate was 35·7 per 1,000. It escaped cholera, and its chief death causes were fevers and bowel complaints. This town has been undergoing improvement in its surface drainage and roads, so that it is now practicable to drive through the town "where before there were only gullies." Masonry side drains are being constructed along all the principal streets. The water-supply is from brackish wells, but a survey for laying down pipes for tank water had been undertaken. Conservancy appears to be fairly carried out by improved latrines.

40. *Akot Municipality.*—This town has a population of 16,137, and yielded in 1885 the enormous death-rate of 57·9 per 1,000, its previous five years' average having been 38·8 per 1,000. Among the deaths were 61 from cholera, 2 from small-pox, 323 from fever, and 293 from bowel complaints. The death-rate from epidemic and endemic diseases was no less than 42 per 1,000. A small extent of surface drainage is being carried out in this town. The water-supply is from wells, and there is some conservancy work done, but in a case such as this we expect more information on the causes of these great losses of life than this Report contains.

41. *Ellichpur Municipality.*—This town has a population of 26,728, its death-rate in 1885 was 35·3 per 1,000, and the previous five years' average rate was 35·9. Of 952 registered deaths in 1885 there were 493 deaths from fevers and 186 from bowel complaints. The town escaped cholera. Extension of surface drains appears to be the only work in progress in Ellichpur, except that a survey had been made for extending the water-supply.

42. *Sanitary Condition of Districts.*—Outside the municipal towns are 27 smaller towns and 5,518 villages, the aggregate population of which is about 2,510,666. The death-rate from all causes in the entire population, excluding the municipalities, would be a little less than the provincial rate, which was 34 per 1,000 in 1885. The deaths from cholera among the non-municipal population were about 3,000, and those from fever about 30,000. The bowel complaint deaths would amount to about 13,000. These round numbers will show the nature of the sanitary problem in the province.

43. The total allotment for all purposes in 1885 was in round numbers Rs. 91,764. Of this sum Rs. 18,533 were expended on civil stations, Rs. 30,407 on non-municipal towns, and Rs. 41,770 on villages. The following were the per-centages of total income devoted to sanitary work :—

Conservancy - - - - -	36·5
Drainage - - - - -	12·9
Water-supply - - - - -	17·5
Total for sanitary purposes -	56·9

The amount spent for sanitary work would thus be in round numbers about 5,000*l.*, a very small amount for so large a population, if it were equally distributed among them.

44. What their necessities are may perhaps be partially learnt from the notes of village inspections made by the Sanitary Commissioner, from which the following facts are taken :—

Village *Loni.*—"Fever prevalent in the village. Three members of the patel's family suffering. "The house was very damp. . . . . A well outside the door, the spilt water from which sinks "into the ground. Recommended patel to remove."

Village *Takli.*—"The approaches to this village filthy in the extreme. Patel pays no attention to "rules."

Village *Dhanaj.*—"Fairly clean. Patel ignorant of sanitary rules for villages."

Town *Karanja* has a population of 10,923, it is not a municipality; it has a constant death-rate of 27 per 1,000; and there occurs the following statement about it which appears to require comment: —"The chief sanitary defect is the absence of drainage, and the dirty condition of the numerous "cesspools, but few of which are constructed of impervious material. Those open cesspools, or "house-mories, are in many instances a public nuisance, but the town committee say they are "powerless to deal with them. This state of matters must make the town unhealthy and feverish."

And then follows a proposal to retain the cesspools, provided the occupiers can afford to have them lined, and in the poorer class of houses to plant shrubs in the sinks. Now this is contrary to all sound sanitary principle. In a town of 10,000 inhabitants no cesspools should be permitted. If the sewage is not removed by drains it ought to be taken away by hand labour to a distance.

The names of five villages are given, of which it is said that "they are all filthy."

Of *Mangrul* town, with a population of 4,900, and a current death-rate of 3 per cent., it is stated that "there is no drainage at all, and all house waste and sullage sinks into the soil of the courtyard. "The outskirts are dirty. . . . Water-supply from a small stream, the banks of which were "very much defiled, as well as the stream itself, in which dirty clothes were washed." There was an outbreak of cholera, which up to the date of report had numbered 41 cases and 18 deaths. The disease was chiefly confined to a quarter in a bad sanitary condition, and out of 70 houses obtaining water from the stream 24 furnished cases of cholera, and nevertheless it is stated that "the town was "fairly clean," affording another illustration that mere surface cleanliness is no test of sanitary condition. In another village in the same taluk water is obtained from a stream, the banks of which are polluted by the people, and the patel stated that he was powerless to stop it.

Village *Dongaon*.—Population 4,259. There is one sweeper and one cart for keeping this village clean, "but the latter has been out of repair for the last five months. . . . The old fort, or "rather between the outer wall and the fort, is almost the filthiest place I have ever seen." The refuse is never removed except by cattle, and the stench is abominable. The death-rate of this small population was 48·34 per 1,000. And then follows this statement by the Deputy Commissioner, Baldana:—"This is an unfortunate place. Its inhabitants are split up into factions, and local self-"government scarcely suits them. The members of the Committee do not work together in "harmony, and the result is that nothing is done."

45. These examples will be sufficient to show the nature of sanitary defects in the smaller population groups. The Sanitary Commissioner who inspected a number of them states the general results as follows:—"The sanitary defects in these villages are for the most part to be found inside "the compound, or house enclosure. Public streets and surroundings are generally fairly clean, but "in many places where large herds of cattle are kept manure stores would be an improvement. "One of the greatest difficulties is with regard to house-mories, or cesspools, situated as a rule "inside the compound, the contents of which sinking into the ground keep the subsoil of these "villages in a damp and unhealthy condition," and it may be safely added that wells dug in such a soil are sure to be polluted. There are village sanitary rules, which are intended to remedy such evils as can be dealt with by simple procedure, but they appear to be very imperfectly enforced, if enforced at all, and the last sentence of the Report says that if the tahsildars "made the patels of "every village they visited produce their sanitary code, and see that it was acted up to, obedience "to the rules would ere long become habitual to the people."

46. In the course of the year 1885 a number of works were completed, or in progress, under the Public Works Department. They consisted chiefly in works of water-supply. The works for Amraoti, including the main, would be completed in 1886, at an estimated cost of 23,459*l*. Another tank, costing 2,862*l*., would be completed about the same time. These works, including five anicuts, are in East Behar division. In West Behar 26 works were in progress, including new tanks, wells, anicuts, repairing tanks, &c., all works of public utility and importance, and many of them advantageous to the public health. But it can scarcely be said that they are likely to satisfy the needs of municipal towns, far less those of villages which the Sanitary Commissioner's Report so fully describes. In none of the localities do the present administrative arrangements appear to be sufficient to deal with epidemic disease causes, which the statistical evidence already adduced proves to have undergone no reduction in times past. What is wanted in all sanitary work is executive system and order, not only in dealing with present sanitary defects but in sedulously preventing their recurrence.

Lastly. As regards the new water-supplies in course of execution, we are desirous of enforcing the great sanitary principle we long ago laid down, that water-supply and drainage for its removal from a town after being used are not two works but one, *and that to conduct water into a town without drainage is simply to add a disease cause to those already existing.*

4th May 1887.

No. 9.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner for Assam for 1885.

1. This Report contains a very full and interesting discussion of the vital statistics of Assam for the year 1885, in relation to the statistics of former years, and so far as the registration can be relied on there is little that could be added to the data to throw more light on the year's sanitary history. As our own work is more related to the results than to the manner in which they have been arrived at, we shall deal only with these and with the sanitary conclusions to be deduced from them.

2. The population datum used in calculating the ratios is that of the 1881 census, namely, 4,526,959, but the statistics of Tura with its small hill population of 744 are given separately.

3. The births registered within the registration area in 1884 were 120,447, or 26·60 per 1,000 on the 1881 census population. In 1885 the registered births had risen to 126,556, or 27·95 per 1,000. The highest ratios of the year were 37·55 in Goalpara district and 38·84 in Cachar, both somewhat below the truth, but by the application of other statistical tests the Sanitary Commissioner has shown that the element of "sex" is still left in doubt, and hence that the data are only approximate.

4. The registered deaths in 1884 were 132,935, or 29·36 per 1,000 of the census population, while in 1885 the number had fallen to 126,344, or 27·91 per 1,000. The birth-rate of 1885 thus exceeded the death-rate of the same year by ·04 per 1,000, a difference too small to be of any importance.

5. The next abstract shows the distribution of the mortality among the districts in 1885 :—

Districts.	Population, 1881.	Deaths Registered, 1885.	Death-rate per 1,000, 1885.
Goalpara - - -	446,232	19,257	43·15
Kamrup - -	644,960	17,795	27·59
Darrang - - -	276,335	7,246	26·51
Nowgong - -	310,579	6,708	21·59
Sibsagar - - -	370,274	8,376	22·62
Lakhimpur - -	179,893	4,279	23·78
Sylhet - - -	1,969,009	53,544	27·19
Cachar - -	289,425	7,744	26·75
Khasi and Jaintia Hills -	43,254	1,395	32·25
Total - -	4,526,959	126,344	27·91

With two or three exceptions these registration numbers are higher than in most Indian districts, but they do not show that Assam is less healthy on that account. Its registration is somewhat better, that is all. About a third of the mortality was registered among children under five years.

6. The vital statistics of tea gardens are much more reliable than those of districts, because all the numbers can be obtained.

The following data give the facts for 1885 in contrast with the district rates :—

Districts.	Tea Garden Population.	Births per 1,000.		Deaths per 1,000.	
		Tea Gardens.	Districts.	Tea Gardens.	Districts.
Kamrup - -	2,919	43·22	26·00	72·72	27·59
Darrang - - -	26,935	17·85	22·48	33·08	26·51
Nowgong - - -	12,302	28·85	25·17	41·45	21·59
Sibsagar - - -	66,112	31·61	27·43	34·64	22·62
Lakhimpur - - -	49,210	26·39	23·91	32·96	23·78
Sylhet - - -	49,239	34·79	26·47	46·26	27·19
Cachar - - -	83,264	38·08	38·84	29·95	26·75
Total - -	289,977	31·84	*27·95	35·50	*27·91

* Including Goalpara and Khasi and Jaintia Hills.

These data appear to show that registration is better done in the tea gardens than in the districts. The garden ratios are much nearer the true rates than those of the districts. The garden rate in Kamrup is very high, but this may be partly due to the comparatively small population of the tea gardens there. The other death-rates can scarcely be considered satisfactory, but in the present state of the district registration they are probably not much above the true district rates if we could obtain them. It would be useful, as we have formerly stated, if the tea garden statistics could be so arranged as to show the deaths among actual workers separately.

7. *Causes of Death.*—The following abstract shows the registered death causes in 1885 compared with the corresponding date for three preceding years :—

——	1882.	1883.	1884.	1885.
Cholera - - -	21,055	14,904	22,273	7,753
Small-pox - -	3,195	6,162	4,781	1,980
Fever - - -	60,218	67,463	66,514	72,482
Bowel complaints -	14,074	14,459	16,153	19,396
Injuries - - -	1,150	1,238	1,180	1,373
Other causes - -	16,228	18,615	22,034	23,360
All causes - -	115,920	122,841	132,935	126,344

It is unlikely that these figures are correct, but as they have been arrived at under the same registration methods, they may be used for purposes of comparison, and they appear to show that diseases of the epidemic class are subject to great variations in prevalence and fatality in different years In

1885 cholera and small-pox were least fatal of any years in the series. The statistical history of each of these diseases is given very completely in the Report, and does not require remark.

8. As regards the far more important data bearing on the removable local conditions, which to a large extent determine the fatality of all epidemics, the Sanitary Commissioner has given the information at his disposal in the form of abstracts of local reports which we shall notice in the sequel. It may be said that these local causes are perfectly well known, which is true, but until they have been fully dealt with it will continue to be necessary to refer to them, and enforce their removal year by year, and hence it may be advantageous to enter more into details, at least in special instances of epidemic outbreaks. We shall see, however, that the Sanitary Commissioner has called pointed attention to local conditions in another way, by showing what has not been done.

It would serve little good purpose to enter into the statistical details, and we shall restrict our notice of the facts to our usual summaries, beginning with cholera.

9. *Cholera* prevailed in all the districts, and during every month of 1885. There are 633 circles of registration, and cholera prevailed in 172 of them; but out of 16,237 villages returns of deaths were received from 1,882 only.

As already has been shown, the deaths amounted to 7,753, equal to a death-rate of 1·71 per 1,000 against a previous five-year rate of 2·92 per 1,000. The country rate was 1·70 per 1,000, and the rate for the towns was 2·18 per 1,000.

10. The monthly incidence of cholera mortality was as follows :—

Months.	Cholera. Deaths.	Months.	Cholera. Deaths.
January	655	July	903
February	351	August	258
March	436	September	138
April	908	October	95
May	1,943	November	66
June	1,511	December	489

There was, as usually happens, a difference in the cholera period in the Brahmaputra and Surma valleys, but it was not so strongly marked as it has been in years of more severe epidemics.

11. *Small-pox.*—There were 1,980 deaths, or ·44 per 1,000, from this disease, or about one-half the previous five years' rate, which was ·87 per 1,000. It prevailed in all the districts, in 172 out of 633 circles of registration, but the deaths were returned from only 702 villages out of 16,237. The country death-rate was ·44 and the town rate ·62 per 1,000.

12. The monthly mortality was as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	146	July	142
February	190	August	62
March	312	September	35
April	417	October	32
May	334	November	38
June	217	December	55

The vaccination report for 1885 is not included in the report under review, but is separately printed.

13. *Fevers.*—The deaths from fevers, which were in the ratio of 14·69 per 1,000 in 1884, had risen to 16·01 per 1,000 in 1885, representing no fewer than 72,482 fever deaths. Fevers were universally prevalent during the year. All the districts suffered, and out of 633 registration circles 555 returned deaths. Out of 16,237 villages 11,049 were affected. All the towns registered fever deaths, but the ratios were under that yielded by the country population, which was 16·12 per 1,000, while the town rate was 11·23 per 1,000.

14. The monthly prevalence of fever is shown in the next abstract :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	4,765	July	7,125
February	4,436	August	6,895
March	4,508	September	6,429
April	4,588	October	6,507
May	6,338	November	7,122
June	6,904	December	6,865

These figures show no signs of an epidemic. They only show that in 1885 most of the mortality took place in the last half of the year, when heat, damp, and drying up were present.

15. *Bowel Complaints.*—Mortality from bowel complaints showed a considerable increase in 1885. The preceding average five years' rate had been 2·76 per 1,000, while in the year under review it had risen to 4·29 per 1,000. These diseases prevailed in all the districts, and in 499 circles of registration, or in nearly five-sixths of the entire number, and deaths were returned from 5,526 villages, or from one-third of them.

16. All the towns returned bowel complaint deaths, with a solitary exception. Their death-rate was 5·04 per 1,000, and the country death-rate was 4·27 per 1,000. Their monthly prevalence was as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January	1,067	July	2,098
February	1,039	August	1,715
March	1,038	September	1,818
April	1,191	October	1,707
May	2,027	November	1,829
June	2,153	December	1,714

On comparing this table with the previous one, showing the monthly mortality from cholera, it will be seen that there is a synchronism between them, at least in the months when cholera was most fatal. It is hence possible that some of the bowel complaint deaths might have been part of the cholera epidemic.

17. *Injuries and all other Causes.*—Not much need be said under these heads. The deaths from injuries amounted to 1,373, or ·30 per 1,000 of the population. They included 107 suicides, 928 woundings or accidents, and 338 deaths by snake-bite and wild beasts. The deaths from *all other causes*, of which no further account is given, amounted to 23,360, or 5·16 per 1,000.

18. We shall conclude this brief abstract of the death causes in 1885 by comparing the rates from cholera in the districts, and in the tea gardens in them, with the general rates already given :—

Districts.	Ratios per 1,000, 1885.			
	Cholera.		All Causes.	
	Tea Gardens.	Districts.	Tea Gardens.	Districts.
Goalpara	—	1·16	—	—
Kamrup	8·11	2·43	72·72	27·59
Darrang	3·67	0·66	33·08	26·51
Nowgong	4·71	0·60	41·45	21·59
Sibsagar	2·35	1·47	34·64	22·62
Lakhimpur	4·69	2·28	32·96	23·78
Sylhet	11·27	1·91	46·26	27·19
Cachar	2·92	1·73	29·95	26·75

These data show that, during a season of low epidemic intensity, the tea garden coolies, who are under medical and sanitary supervision, suffered far higher cholera and general death-rates than those of the outside civil population, and, as the amount of cholera mortality is a good index of local sanitary condition, we can arrive at no other conclusion than that much improvement is required in these gardens.

The Sanitary Commissioner's opinion on the tea garden question is as follows:—"The lower rate "of mortality which has been recorded among this class of the population in 1885 is merely in "harmony with the healthy character of the year all over the province. I have had further opportunity of seeing conditions under which the immigrants are placed, and there can be no reasonable "doubt but that these are very variable. In many gardens the management is concerned to "provide all sanitary improvements regardless of cost, under fully qualified medical advice; in "many others the tendency is not to interfere with the prejudices of the natives, and to take things "as they come. But, on the whole, there is substantial progress, and the more light there is thrown "on the subject the better prospect for the health of the labourer and the welfare of the "property."

In all these gardens there are responsible parties to whom belongs the duty of executing any sanitary works or improvements required to ensure the health of workers, so that strict and frequent inspection and report would appear to be the best means of ensuring execution.

10. *Sanitary Works (Civil).*—Under this head are given returns of expenditure for 20 towns, unions, stations, and municipalities. The total amount spent during the year was in round

numbers 8,942*l.*, of which the following proportions were spent on sanitary works properly so called :—

	£
Drainage - - - - -	949
Water-supply - - - - -	1,132
Conservancy - - - - -	2,035
Disposal of dead - - - - -	86
	£4,202

Under other heads of expenditure are included :—

	£
Medical relief - - - - -	438
Vaccination - - - - -	90
Roads and culverts - - - -	3,579
Markets and slaughter-houses - -	187
Village sites - - - - -	—
Other sanitary improvements - - - -	424

Most of the outlay has been incurred for the towns, but the amounts appropriated are too limited to have enabled much effective work to have been done.

20. The general result of the year's work cannot be better summarised than in the following passage of the Sanitary Commissioner's Report, which, however, refers chiefly to the towns :—"In "the Assam valley there is little of novelty to occupy attention. The Goálpára drainage is still "reported ineffectual as a scheme. In Gauháti the well-sinking for the future water-supply was "almost at a standstill. In Nowgong a large and improved drainage project is being considered. "In Sibsagar, the conspicuously able report of the Vice-Chairman, Babu Ganga Govinda Phukan, "includes a well considered project of developing the dispensary into an institution capable of pro- "viding medical relief to all classes. In Dibrugarh there is marked local energy. In the sub- "divisional townships the reports indicate closer attention to details of conservancy, protected water- "supply, and drainage; but in most of them efforts to grapple with almost insuperable difficulties "are hampered by insufficient funds. Throughout the valley the health of the people is reported to "have been unusually good, and food supplies of all kinds abundant. The sanitary record of Sylhet "is characterised by the Vice-Chairman as 'a move in the right direction, and hopeful of good "'results for the future.' In Sunamganj, Habiganj, Karimganj, and Maulavi Bágái the reports "are full to overflowing, and it is plain that interest has been awakened in the subject which may "gradually develope into action. During my inspection of the district and personal communication "with local authorities it seemed clear that most of them were well acquainted with the sanitary "requirements of their charge, but were for the present overborne by prejudices of the people and "inadequate means to reform the daily habits of such a teeming population. In Cachar the Deputy "Commissioner's energy and tact are producing systematic registration, conservancy, and protected "water-supply. A large sum of money has, however, been spent in excavating a tank, which is "neither of general use nor a particular success. Wells with pottery rings should be substituted for "tanks. . . . . In Assam sanitation is yet so crude and the natural obstacles to improvement "so tremendous, that one cannot avoid a certain feeling of regret in contracting official discussion. I "hope, however, that the increased attention which has been given to it of late will not diminish "simply because the printed report is shorter."

21. The only addition to this rapid outline of the reports which it is necessary to make is that in the preceding heads of expenditure it will be seen that nothing had been spent in improving village sites. And in another paragraph it is stated that "the habits of the people predispose them to "malarious fevers, and the general conditions of life in all the villages are most insanitary." These fevers are, however, mainly due to water-logged sites and consequent dampness of dwellings, showing the need of site improvements.

22. The district reports themselves are given in brief abstracts only, but they contain a few statements which are of interest as bearing on the general questions of sanitary condition and improvement.

The drainage expenditure is mostly "so insignificant as to suggest that the existing drains merely "had their annual scraping and clearing."

"At Dibrugarh some good wells have been dug, and pumps fitted. This is an example which "might be followed with advantage wherever the water level and nature of the soil offer facilities. "There are numbers of good wells, pumps, tanks, and ball taps scattered throughout the province, "and all that are in good order are in constant use. It is tiresome to have so many officials urging "that the people prefer tank water, and that the latter is wholesome and protected. Open tanks are "the most potent disease factors in Assam."

23. The sanitary questions raised in this extract are briefly as follows:—Wells dug in clean ground down to the level of pure water-bearing strata, from which all foul drainage has been cut off and the well properly constructed and covered, as described in our "suggestions," will yield good wholesome water. On the other hand, tanks are merely storeage reservoirs, receiving their supply either from the immediate subsoil, or from collecting areas around them; and if they are used for water-supply they must be subject to the conditions which are everywhere necessary, and these are that the entire

collecting surface must be kept clean and free from all soluble organic matter, while the tank itself must be strictly and rigidly used for domestic purposes. In sanitary administration, "what the people "prefer" is a principle which *per se* admits of no application.

24. Under the head of "disposal of the dead," the following remark is introduced, which contains a principle applicable to all sanitary proceedings, provided there be an executive authority to ensure execution:—"It is not to be expected that epidemic disease will ever be got under control until local "government has grappled with this question, and placed both interments and cremation under "strict byelaws."

25. Regarding the district sanitary reports, the remark is made that "they are too often a trans- "literation of the figures only," that is, that they are not sanitary reports. Statistical data, however accurate, can never do more than tell us the extent, nature, and locality of deaths; but they can no more tell us the causes of the losses or the remedies than a statement of accounts and losses can pay a bankrupt's debts. The three necessary things in a sanitary report are the disease and death statistics, the local causes, and the local improvements required to remove these causes, but such a report again implies an executive and execution, or it is of no utility practically.

26. Referring to the drainage of Gauhati and its water-logged subsoil, the reporter makes a remark of some importance. He says that "more attention should be given to opening and clearing "small subsidiary drains and freeing the habited portion of the town of much stagnant water." This is quite true, and belongs to a large class of examples in which much good may be done at small outlay. This is the district where the average age at death is so low, to which we alluded in a former Memorandum, and the Deputy-Commissioner is quoted in the Report under review for the statement "that there are very few people in that water-logged unhealthy tract who live beyond "40 years of age." Is not this a case where the choice lies between improving the district or removing the people?

27. Of *Darrang* it is reported that "the water-supply of the entire district is bad."

28. Some improvement is reported in the tea gardens and district of Lakhimpur, and of Dibrugarh it is stated that the Vice-Chairman "is untiring in his efforts to open up spaces in the town, to fill "up excavations, to construct new roads, to block the tanks from surface draining, to sink wells and "fit pumps, to improve the market places, to provide numerous latrines, to regulate bazaar buildings, "to cut down noxious undergrowth, and superfluous vegetation."

This is all good work, and if persisted in will help to improve the public health, but as this town had a high general and cholera death-rate it would appear that further steps should be taken, possibly in the direction of better conservancy and drainage.

The Sanitary Commissioner adds that "no more excavations for brick making are to be allowed "within municipal limits. It is deplorable to observe the filthy water-holes which disfigure most of "the stations in Assam from this and similar works." It may be here stated that digging clay in a malarial country, indeed that all disturbances of the subsoil increase the risks of fever attacks.

An example of this risk is apparently afforded by the experience at Bálisirá, where the prevalence of fever is attributed to "the opening out new tea gardens, to a very hot season, followed by "abundant rain, and to drinking unfiltered surface drainage water."

29. It is stated that "many material improvements have been effected in the tea gardens of "Cachar during the year in the direction of improved barracks, water, food supplies, and "clothing."

30. Of *Shillong* it is stated that "the drainage and water-supply continue first-rate," and the Vice-Chairman considers that with the means at their disposal no better system of conservancy could be adopted; but in the opinion of the Sanitary Commissioner "a trusty and energetic inspector of "nuisances is required, and sanitary requirements carried out by efficient byelaws." This is true; but such an official is required everywhere in India and with suitable means of having his behests obeyed he would soon make an impression on the epidemic mortality.

31. *Coolie Immigrants.*—The real causes of mortality among coolies in their transfer by the Brahmaputra to the tea gardens are now in fair process of being ascertained. It was supposed that what is called the *cholera water theory* afforded the explanation. But it now appears that the chief cause of coolie predisposition to cholera attacks was the presence of an epidemic along the route on one or both sides of the river, the long voyage through an epidemic district (12 to 14 days), crowding on board the vessels, and absence of sanitary precautions generally. In 1885 there were 15,503 labourers embarked at Dhubri and 2,543 at Goalunda. Among the former there were in all 24 deaths, of which 16 were due to cholera and 4 to infantile diseases. Among the Goalunda immigrants there were seven deaths. The death-rate from Dhubri had been ·15 per cent. and from Goalunda ·27 per cent. Instead of being detained for so many days on the river in crowded vessels, the labourers were carried in 215 trips by the mail steamers, the average duration of the trips having been 4 days 23 hours, and the result is very properly attributed by the Sanitary Commissioner to the adoption of measures of protection "founded on general sanitary principles "rather than on any single theory." But it must be stated that the improved death-rates only represent a five days' period, and not an annual ratio. Hence there are details in which the service could still to be improved on "general sanitary principles," and with this favourable experience there seems no reason why better results might not be arrived at.

The mortality among the Cachar immigrants requires to be dealt with, In the course of the year 2,793 coolies passed through the Silchar depôts, of whom 100 died in route, chiefly from cholera, and 129 were admitted into the hospital at Silchar. The figures are almost incredible.

32. In conclusion, it is evident from the details we have given that, in the midst of considerable climatic and topographical difficulties, some progress is being made in sanitary work in Assam. The season was what is called a healthy one, that is, there were fewer deaths than usual from epidemics, but there is no proof in the Report that any part of this improvement was due to sanitary work. A beginning only has been made at certain points, while the villages are much as they were. So far as we can judge, the Sanitary Commissioner has given a fair and unprejudiced account of the actual state of matters, and this forces us to the conclusion that Assam stands in need of the same great sanitary reform as other Indian Governments, that is, it needs a skilled and efficient sanitary executive.

4th February 1887.

No. 10.

Memorandum of the Army Sanitary Commission on the Report of the Sanitary Commissioner of Lower Burma for 1885.

1. The information in this Report refers to the same area of Burma as reports of previous years, and its date is anterior to the recent annexations.

2. The population element used in calculating the ratios is that of the 1881 census, but it is probably under the real number from immigration as well as from natural increase.

The area occupied by the population was 75,087 square miles, at the rate of between 48 and 49 inhabitants per square mile.

3. The births registered in 1885 were those of,—

Males - - - -	48,059
Females - - - -	45,163
Total - -	93,222

The birth-rate was 25·51 per 1,000, probably much below the actual average, but still showing good registration work.

4. In the same year the deaths registered numbered of,—

Males - - - - -	40,539
Females - - - - -	32,133
Total - - -	72,672

or 19·89 per 1,000, showing also better registration, as the previous five years' average was only 16·65 per 1,000.

Town death-rates were much higher than country rates. The highest rate of the year was that of Pegu, which reached no less than 68·41 per 1,000. The average death-rate for all the 20 towns was 29·48 per 1,000, while the average town birth-rate was 23·44 per 1,000. These rates show that the town registration is better conducted than that of country districts at present, but there is every probability that the town rates are under the truth. It may be safely taken for granted, however, that registration in British Burma is improving.

5. The following were the registered death causes in 1885 :—

Causes of Death.	Total Deaths.	Deaths-rate per 1,000.
Cholera - - - -	7,685	2·10
Small-pox - - -	2,120	·58
Fevers - - - -	34,070	9·32
Bowel complaints - -	3,254	·89
Injuries - - - -	666	·18
All other causes - -	24,877	6·81
All causes - -	72,672	19·88

But before dealing with the facts under each head for the year under review we shall give the past statistics for cholera, which were as follows. The data are for 14 consecutive years, and they will enable us to estimate the present susceptibility of the population to this epidemic in relation to that of former years:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1872	640	1879	1,828
1873	8,109	1880	2,638
1874	960	1881	5,239
1875	761	1882	7,177
1876	3,678	1883	2,185
1877	7,276	1884	5,515
1878	6,759	1885	7,685

Data of this class show the results of varying yearly intensity of cholera in Burma; they also prove that any sanitary measures which may have been adopted have failed to reach the localizing causes. But the figures show more than this, for the fatality of cholera has been increasing in Burma.

The first seven years in the table, which include the Madras famine years, yielded about 28,000 deaths, while during the second series of years the mortality was represented by about 32,000 deaths; but part of the apparent increase may be due to more cholera deaths being registered. Any way the table shows no decrease in cholera mortality in recent years.

6. The cholera of 1885 was, so to speak, scattered over the whole province. Deaths from it were registered all along the sea-coast from Mergui in Tenasserim to Akyab in the north of Aracan, but the disease was of most frequent occurrence along the rivers and in the river deltas. Each of the 16 districts of Burma yielded deaths in 1885, and in the month of January the disease had shown its presence in 12 of the 16 districts in localities widely separated from each other. The peculiar character of the epidemic is shown by the fact that while in the course of the year all the districts suffered more or less, the disease was fatal in no more than 138 registration circles out of 843 into which the districts are divided, while the whole year's mortality was reported from 219 villages out of 14,811. But each of the 20 towns registered deaths.

The country districts yielded 6,343 deaths, or 1·97 per 1,000 of the population, and the towns 1,342 deaths, or 3·13 per 1,000. The cholera death-rate for the entire population was 2·10 against a previous five years' rate of 1·27 per 1,000.

7. The following abstract shows the monthly prevalence of cholera in 1885:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January	566	July	994
February	462	August	1,037
March	356	September	401
April	765	October	524
May	1,013	November	586
June	692	December	289

The information regarding cholera in this Report is exclusively statistical, and calls for no special remark.

8. *Small-pox.*—The next abstract gives the registered deaths from small-pox for a period of 14 years:—

Years.	Small-pox Deaths.	Years.	Small-pox Deaths.
1872	845	1879	2,297
1873	1,416	1880	5,402
1874	1,191	1881	1,766
1875	752	1882	770
1876	1,335	1883	675
1877	1,230	1884	6,102
1878	1,406	1885	2,120

These figures show that small-pox in certain years takes on the epidemic form in Burma as in other Indian provinces, or, what is more probable, it undergoes periods of local increase, while the larger the number of localities affected in this way, or the greater the local fatality, so much the greater will the epidemic appear to be. In a long and widespread country like Burma, this feature of the disease appears to be shown by the experience of 1885 as follows:—Out of 843 registration circles, small-pox deaths were registered in 78 only, and these were situated in all the districts, while the entire mortality took place in 103 villages out of 14,811. The small-pox deaths in the country districts numbered 1,630, or ·51 per 1,000, and, in the towns, 18 of which out of 20 returned deaths, the deaths from small-pox amounted to 490, or 1·14 per 1,000. In 1885 there were for the whole province 2,120 deaths, or ·58 per 1,000, while the previous five years' average rate had been ·86 per 1,000. Of the small-pox deaths in 1885 there were 348 registered at ages under one year.

9. *Vaccination.*—According to the vaccination returns the average number of vaccinators employed during the year was 64. The total vaccinations performed were 63,516, of which 48,810, or 81·36

per 1,000, were reported successful. Of these successful cases, 10,020 were under one year of age, while the births registered were 93,222, or above ninefold the number vaccinated under one year. During the previous five years the average vaccinations were in the annual ratio of 14·23 per 1,000 of the whole population, and the small-pox death-rate averaged ·86 per 1,000.

10. The vaccination establishment for the official year 1885–86 stood as follows:—

Superintendent-General	1
Superintendents of Circles	19
Deputy Superintendents	1
Native „	5
Vaccinators, 1st Class	20
„ 2nd „	39
Chuprasees, &c.	3
Total staff	88

It cannot be said that the year's results of this service have been altogether satisfactory, but of this circumstance the nature of the country is to some extent a cause. Both Government and the medical service are fully alive to the facts, and are attempting to improve the service.

11. *Fevers.*—There were 34,070 deaths registered as "fevers" in 1885, but, as we shall presently see, there are reasons to doubt the accuracy of the returns. The figures as they stand represent a death-rate for the year of 9·92 per 1,000, with a previous five years' average of 7·81 per 1,000.

12. Mortality from fevers took place in all the 16 districts of Burma, and out of 843 circles of registration 573 returned deaths, but only 1,665 villages appear to have suffered out of a total of 14,811. Moreover, all the towns returned fever-deaths, so that it is highly probable that fevers were more prevalent and fatal among the country populationt han the statistics would lead us to infer. We must, however, take the figures as they are, and these give the following monthly deaths, alongside which we have placed the monthly humidity and rainfall:—

Months.	Fever Deaths.	Average Rainfall.	Average Humidity.
		Inches.	°
January	2,830	·32	60·14
February	2,103	·36	57·43
March	2,034	·31	53·86
April	2,085	1·00	56·29
May	2,261	4·99	62·36
June	2,224	28·69	82·50
July	3,176	33·39	88·14
August	4,101	41·93	86·64
September	3,653	12·81	82·00
October	3,515	6·34	80·43
November	3,123	3·67	78·29
December	2,065	·015	72·36

It will be observed that, however imperfect the fever registration may have beeu, there was a large increase in the number of deaths in the second half of the year, and, by comparing the monthly deaths with the average rainfall and humidity, it follows that the increase was preceded and accompanied by a great increase of both of these elements of climate.

13. But these last are only averages deduced from widely separated areas of country, within which the actual rainfall varies greatly in amount. Thus the average rainfall for the whole of Aracan was 218 inches, for Pegu 69 inches, for Irrawaddy 82 inches, and for Tenasserim 153 inches, and the average fever death-rate in 1885 was for Aracan 12·83, for Pegu 8·84, for Irrawaddy 9·55, and for Tenasserim 7·20 per 1,000.

14. We have no account as yet of the climate and fever mortality of Upper Burma, but we have the following data for the two districts of British Burma, which are coterminous with Upper Burma, These are, Prome, with a rainfall in 1885 of 46 inches, and a fever death-rate of 13·74 per 1,000. and a previous five years' average of 8·78 per 1,000; and Toungoo, with a rainfall of 84½ inches, and a fever-rate of 6·53 per 1,000, against a previous five years' rate of 6·03. Of course, in comparisons of this kind, other elements beside rainfall come into account; such, for instance, as local topography, soils, subsoils, rivers, surface drainages, and the like.

15. For the whole of British Burma the fever-rate among the country population was 9 47 and for the towns it was 8·23 per 1,000. As already stated, for the province as a whole the fever death-rate was 9·32 per 1,000.

As the paragraphs relating to fever are only statistical and not sanitary, it is unnecessary to say more on this subject, except that the Report contains no statistical data to show what has been the past history of fever in the provinces.

16. A similar remark as to absence of sanitary information is applicable to diseases reported as *bowel complaints*, in regard to which a few statistical facts alone are given. These, beginning with the past history, are as follow:—

Years.	Bowel Complaint Deaths.	Years.	Bowel Complaint Deaths.
1872	4,804	1879	3,332
1873	5,099	1880	3,500
1874	4,360	1881	3,808
1875	5,212	1882	3,291
1876	5,269	1883	2,781
1877	6,879	1884	3,719
1878	4,640	1885	3,254

According to this abstract there were 3,254 deaths registered as of bowel complaints in 1885, yielding a death-rate of ·89 per 1,000, the previous five years' average having been ·97 per 1,000. Divided between town and country populations the rate for the towns was 2·84 and for the villages ·63 per 1,000. Bowel complaint deaths were returned from all the districts and from all the towns except two. But the returns were evidently inaccurate, as is shown by the fact that only 124 registration circles out of 843 reported deaths, while out of 14,811 villages all would appear to have escaped except 125.

17. *Injuries.*—Under this head 666 deaths, or ·18 per 1,000, were registered.

18. *All other causes* yielded 24,887 deaths, or above a third part of the total deaths registered, namely, 72,672.

19. These facts taken from the mortality statistics of 1885 prove that, while much has been already done in organizing the vital statistics of this province, the results show progress in the work rather than the actual acquisition of reliable data for public health purposes, and we must hope for increasing improvement when the whole of Burma is brought under registration.

20. We have already called attention to the fact that under the statistical heading for each death cause there is no sanitary information as to their observed local causes, and we shall next show what information of a general character the Report contains on the sanitary state of districts and towns.

There is evidence in the District Surgeon's reports that simple sanitary principles are better understood and applied in Burma than in India. Hence there appears to be more attention paid to water-supply and surface cleaning and removal of sewage. The chief defect stated is in the use of cesspits for household purposes, and hence constant danger of subsoil pollutions and sewage impurity in well water.

In the towns works of drainage and water-supply are in progress in some districts, but in such cases as Akyab there are local difficulties requiring skilled sanitary engineering aid and supervision for their removal. In Rangoon sanitary works appear to be making progress, but in the absence of details and plans we can give no opinion about them. It is proposed to adopt Shone and Ault's pneumatic system of drainage. But before doing so we would beg to suggest for inquiry how far it has been in use in this country, and whether the results have been such as to justify its application to the conditions of Indian climates; and further, if mechanical power for drainage be required, whether there are not modes of accomplishing this object much simpler and cheaper. It is stated that in this town the demand for building sites has increased so rapidly that extensive reclamations of swampy ground have had to be undertaken by canal drainage and raising of the surface by using the excavated material. In all such improvements it is, of course, necessary to proceed with foresight, so that future dwelling-houses may have their foundations sufficiently raised and so formed as to keep damp from rising from the subsoil, which is a sure cause of fever and other epidemic diseases in tropical climates.

21. *Sanitary Works (Civil).*—The following were the items expended by the Public Works Department in 1885, in all the divisions, for new works and repairs:—

	Rs.
Water-supply	22,326
Drainage	6,846
Latrines	2,177
Markets	34,005
Burial grounds	1,512
	66,866

This amount was chiefly spent in a certain number of towns in providing tanks and wells, and in cleaning out and repairing wells, in draining ground; in one case draining a village site, improving the surface of bazars; in increasing the number of and repairing of latrines, in the extension and construction of bazars and market repairs, and in repairs of burial grounds.

Considered in relation to the disease statistics these works are making progress in the right direction, but the amount of cholera and its apparent increase, as well as the increase of mortality from fever, point to the necessity of paying more attention to town and village drainage and to means of preserving and purifying the subsoil.

22. On this branch of sanitary work we cannot do better than include in the present Memorandum the following paragraph of the Sanitary Commissioner's Report, in which the questions are raised :—

"Looking to the fact that, except in Rangoon and other large towns, cesspits, in this as in other eastern countries a fruitful source of annoyance and disease, must continue to be generally used, the Chief Commissioner asked me to examine a number of them, and after consultation with selected experienced officers to make somewhat practicable suggestions for obviating or minimizing the evil arising therefrom. When on tour I have examined a great many pits and have consulted many officers, but without much prospect of solving the difficulty. Cesspits in small villages and in country places are unobjectionable, as they can at a trifling cost of money or trouble be kept inoffensive and free from danger. In towns where the houses abut against each other, and where compounds are circumscribed, the conditions are very different, and at certain seasons, as during the rains, in spite of every precaution, or rather in spite of all practicable precautions, it is impossible to ensure that cesspits will not contaminate the water-supply or the atmosphere. The chances of danger may be reduced by lining the pit with an impermeable structure, by using ashes or dry earth as a deodorizer, and by regular cleaning out. But people civilized enough to undertake these precautions will easily be persuaded to adopt latrines with pails which can be emptied periodically.

"It is the teaching of universal experience that people who wish to live healthily in large communities must be specially careful of the sanitary conditions of their surroundings, and it is almost equally true if the surroundings of each individual are left to himself, that is if there is no sanitary organization or responsible agency they are very insanitary, and my inspections during the past year confirm this view. However, I would urge in the case of all towns that pressure be brought to bear for the gradual abolition of cesspits, which are very generally nothing more nor less than unsightly bad smelling dung-heaps, and the introduction of latrines on the principle just indicated."

23. This statement is an important one and may be ranked with the conclusions of the other Sanitary Commissioners on the present condition and future prospects of sanitary work in the East, for it really includes the principle elements of epidemic causation and the means of removing or lessening them. Surface cleansing, subsoil purification and drying, protection and provision of water sources, and atmospheric purity are all included, for all departments of sanitary work are only branches from one common root.

There can be no foul ground round tanks without constant danger to the purity of their contained water. No cesspits can be dug in the same house or compound area as the house well without directly polluting the water, and this rule holds good in villages as well as in towns. There can be no subsoil damp under houses without fever and other epidemic diseases, the causes of which take their origin in filth in the subsoil as well as in damp and stagnant subsoil water, so that the whole sanitary problem in Burma is the same, in principle at least, as it is in India and in Great Britain. Hence the question resolves itself merely into a question of methods and their relative economy.

24. For example, it would be almost, if not altogether, impossible to cleanse every house in London by hand removal of sewage, and the cost itself would be prohibitory. Yet the entire sewage of above three and a half millions of people is removed far away from the houses within an hour after it is produced, by water-supply and water carriage. The sewers and drains have been very costly, but they do their work effectually, and, what is of great importance, no cesspits are required.

25. There are towns abroad where huge cesspits have been made, at great outlay per house, to receive and hold the sewage until it can be raised by atmospheric pressure into air-tight carts and removed. Practically, however, houses so dealt with are liable to enteric fever outbreaks and other house diseases.

26. So far as we can form an opinion from the facts in the present and preceding Reports, we may state the following principles as applicable to Burmese towns and villages :—

(1.) In the more populous towns abolition of cesspits and the removal of sewage by water carriage, which involves a separate water-supply, is by far the safest, most convenient, and most civilised remedy for present defects ; but its applicablity in any particular case, and also the manner of doing the work, must be determined by skilled sanitary engineers.

(2.) Where this improvement cannot for the present be adopted, cesspits ought, nevertheless, to be abolished, and methods introduced for collecting and removing house sewage without retaining it at all, and without allowing it to pollute the surface or subsoil. Measures of this kind require knowledge and practical skill in their application, and a wholesome water-supply would at the same time be required in cases where house wells have become polluted from the past use of cesspits.

(3.) With reference to the villages, similar principles require to be adopted, for there is just as much risk to health from well water polluted by cesspits and middens in a small village as there is in a large town. It is true that in the case of villages there is an alternative, and this is to keep the places of deposit of all sewage matters at such a distance from the house well as to be completely beyond the area from which the well derives its water.

(4.) In all cases, whether in town or country, rules for maintaining surface cleanliness and for keeping cattle apart from human dwellings should be applied.

For further information on these matters we would refer to our Suggestions for the Sanitary Improvement of Indian Stations and their vicinity (1882 edition), in which the principles are more fully stated.

23rd March 1887.

No. 11.

Memorandum of the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary, and Jail Report for 1885.

1. The present, like former reports, includes two classes of sanitary facts, those for Ajmere-Merwara, which are given in the same form as similar details for other Indian Governments, and certain facts for the Native States of Rajputana, which from the nature of the case are not so complete as those for Ajmere division.

2. The population of Ajmere-Merwara in 1881 was 460,722, and for 14 out of 16 Native States it amounted to 9,354,163, giving for the whole of Rajputana a population of 9,814,885. We shall abstract the information regarding each population group separately.

3. Among a population of 460,722 in Ajmere division there were registered in 1885 the births of 6,323 males and 5,248 females, together 11,571 births, yielding a ratio of 25·11 per 1,000 for both sexes on the population of 1881. The lowest birth-rate recorded was 10·84 per 1,000, in Nyanagar rural circle, and the highest, 43·29, in Nasirabad town. A considerable number of the birth-rates exceeded the average, which, although too low, nevertheless shows good registration work.

4. During the same year, 1885, there were registered the deaths of 5,561 males and 4,502 females, in all 10,063 deaths, or 21·84 per 1,000. The highest rate of the year was 36·76 per 1,000 in Nyanagar town, and the lowest, 10·61, in the same rural circle. The death-rates are not so well registered as the birth-rates, and the average is under the real rate. There appears to be an average condition of registration efficiency, for the rate of 21·84 per 1,000, for the year under review does not much exceed the previous five years' average, which was 21·07 per 1,000.

5. *Death Causes.*—The following were the registered death-causes in Ajmere-Merwara in 1885:—

Diseases.	Deaths.	Deaths per 1,000.
Cholera	100	·22
Small-pox	1,306	2·83
Fevers	5,995	13·01
Bowel complaints	1,318	2·86
Injuries	233	·51
All other causes	1,111	2·41
All causes	10,063	21·84

6. *Cholera.*—There are 18 districts and 5 towns in Ajmere-Merwara. Of the districts, which have a conjoint population of 370,391, deaths from cholera were returned from 9. They were 75 in number and yielded a district death-rate of ·20 per 1,000 for the whole population. But the weight of the epidemic fell on Ajmere town district which had a death-rate of 4·89 per 1,000. The towns proper, with a population of 90,331, yielded 25 deaths, or ·28 per 1,000. But Ajmere town had a cholera rate of ·25 per 1,000. Ajmere town district and the town itself suffered much more than any other portion of the province. Their population amounted in 1881 to 49,151, and out of a total of 100 cholera deaths this population yielded 63. The experience is not new; it is simply a repetition of what has occurred in former years. The year's cholera death-rate for town and country circles was ·22 against a preceding five years' rate of ·27 per 1,000.

7. There is no more information than there has been in previous reports to show why Ajmere and its vicinity has suffered so much, but it is quite clear that there must be something at fault, and the practical deduction from the statistics is that an exhaustive inquiry into the facts and their causes should be undertaken, and reported for removal. The statement of the Civil Surgeon with regard to an affected part of Ajmere scarcely meets the necessities of the case. He says: "I went over all "this part of the city with one of the members of the municipal committee when the disease was at "its height, and found very little to complain of in the way of cleanliness." But, as we have often pointed out, mere surface cleanliness is no test of sanitary conditions. Epidemic causes are, for the most part, within houses and compounds or in the subsoil. It would appear as if the manner in which cholera showed itself pointed to the influence of locality, for the Civil Surgeon states that "the "disease did not spread regularly, but appeared in various localities, the victims very seldom having "anything—drinking water, residences, or circumstances—in common." The outbreak appeared to have been endemic rather than epidemic in character, and this feature of it within a defined area, while other areas in the same district escaped or nearly escaped the disease, would appear to indicate the operation of purely local predisposing conditions. At all events, and so far as cholera is concerned, Ajmere must on this basis of past experience be considered as a cholera infected locality and as such should be dealt with by skilled technical work.

8. Out of 23 circles of registration, cholera appeared in 12, and deaths from it were registered in only 15 population groups out of 739.

January, February, and March were free from cholera, and the epidemic was limited as follows:—

	Deaths.
April	18
May	32
June	26
July	14
August	9
September	1
Total	100

9. *Small-pox* was a much more fatal disease than cholera in the year under review. Deaths from it were returned from all the registration circles and from 176 population groups out of 739 in the government. Every month yielded deaths in the following proportions:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January	15	July	94
February	51	August	46
March	190	September	9
April	289	October	13
May	277	November	56
June	186	December	80

There were in all 1,306 deaths, or 2·83 per 1,000 of the population, against a previous five years' average of 1·96 per 1,000. The death-rates varied greatly in different localities. Nasirabad town had a death-rate of ·14 per 1,000, Ajmere of 4·14, and the death-rate in Pisangan town attained the maximum of 8·61 per 1,000. The disease had a distinctly epidemic character up to August, and then there followed what appears to have been another outburst of the disease.

10. *Vaccination.*—This service was carried out by six vaccinators, and in the course of the year 3,772 operations were performed, of which 3,367 were reported successful. There were 26 re-vaccinations performed, of which 17 were successful, a result scarcely indicative of good primary work in these cases at least. Of the primary vaccinations 1,667 were at ages under one year and 1,625 between one and six years, so that 3,292 operations out of 3,367, that is all except 75, were performed at young ages, but when we contrast the entire vaccination work with the births registered, which were 11,571, we have an element of inefficiency at hand which would account for part of the loss of life, but at the same time, as has been already pointed out, the disease was epidemic in character, and this aspect of it must be met by improving the sanitary condition of the people. As we shall presently see, vaccination appears to have made more progress in the Native States than in Ajmere-Merwara.

11. *Fevers.*—More important to the public interests than either cholera or small-pox are the diseases classed as "fevers," from which there were registered 5,995 deaths, or 13·01 per 1,000 of the population. Every registration circle and every population group in town and country suffered, and the disease prevailed almost equally during every month of 1885, as the following table shows:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January	562	July	405
February	460	August	431
March	573	September	508
April	555	October	488
May	458	November	487
June	400	December	668

The deaths from fever have been nearly the same annually for six years. During the five years preceding 1885 the ratio was 13·44 per 1,000, and in 1885, as we have seen, the rate was 13·01. The fever death-rates were lowest in Merwara, where they lay between 6 and 10 per 1,000. The lowest rate in Ajmere was 7·68 per 1,000, and the highest, 24·60, in Pisangan town. But there was an exceptionally higher rate than even this one in Nyanagar town in Merwara, which returned a fever death-rate of 25·65 per 1,000. The rate in Ajmere town was 11·76 and in its suburbs 16·17 per 1,000. No account is given of the causes of these fevers.

12. *Bowel Complaints.*—Deaths were returned under this head from all the circles of registration in Ajmere-Merwara and from 383 out of 739 population groups. Every month yielded deaths, numbering in all 1,318, or 2·86 per 1,000 against a previous five years' rate of 2·31. The diseases classed as bowel complaints were chiefly diarrhœa and dysentery, and, as a general rule, they appear to have been most fatal in towns where other epidemics were fatal. Thus, Ajmere had a death-rate from bowel complaints of 5·72 per 1,000, or ten times its rate from cholera. The rate in its suburbs was 4·77, nearly the same rate as that from cholera, which was 4·89. Again, Nyanagar town registered no cholera death-rate, but its fever-rate was 25·65 and its bowel complaint rate was 8·78 per 1,000. The facts, in the absence of definite sanitary information, all point in the direction of local causes requiring examination and removal.

13. *Native States.*—We shall next give briefly such data as the Report contains on the sanitary condition of the Native States. As has been already stated, the population of 14 out of 16 Native States at the census of 1881 was 9,354,163, but the registration of births and deaths is as yet confined to five States and nine cities, and of these one State and one city had not made returns of population, births, or deaths. Of the four States and eight cities making returns the population was 1,888,199, and it is to this number that the following remarks apply.

14. The births registered in 1885 were 30,389, or in the ratio of 16 per 1,000.

15. The deaths registered in the same population were 25,142, or in the ratio of 13 per 1,000.

16. Both rates are of course much below the truth, but we must bear in mind that such as they are they have been supplied by the voluntary efforts of purely Native agencies. The results have proved that it is possible to obtain statistical information by those means, and we must expect progressive improvement in the data in time.

17. The usual disease classification has been adopted in these Native returns as follows:—

Diseases.	Deaths.
Cholera	1,456
Small-pox	1,033
Fevers	13,711
Bowel complaints	2,098
Snake-bite	66
Injuries	315
All other causes	6,463
All causes	25,142

The deaths from cholera in this table do not include all the deaths in the Native States, which numbered 2,065 out of 3,166 cases, giving a mortality of 65 per cent. of the cases.

18. Epidemic cholera appeared on 21st March and continued until 15th October. One outbreak at Tonk took place "amongst a crowd of people, living in an insanitary condition, who had assembled "to celebrate a marriage." This was in May. It subsided, but again returned in July.

Another violent outbreak took place at the Ramdeova fair in Jodhpore State; 342 corpses were counted in the vicinity. "It is to be hoped," says the Agency Surgeon, "and expected that some at "least of the insanitary conditions which prevailed as the last gathering will be removed before the "pilgrims again assemble, and that a hospital may be opened during the time of the fair." If the former recommendation be attended to there will probably be less need for carrying out the latter.

19. Deaths from small-pox were returned at 1,033, but as 371 of these deaths were returned from the city of Jeypore, and 364 from the city of Oodeypore, there is every probability that the small-pox mortality was largely understated. From a fact stated by the Agency Surgeon at Jeypore it would appear that small-pox is considered a matter of ordinary occurrence in these States, for he mentions that an intelligent Native modeller, who had received an order for models of 60 male heads of the leading castes in Jeypore, "painted on the faces of no less than nine abundant small-pox marks, while "two are represented as having only one eye each."

20. *Vaccination* in the Native States was carried out by 118 vaccinators, who performed 154,631 successful primary operations, and 549 successful re-vaccinations, out of a total of 709.

We have no information as to the ratio of births, vaccination, and small-pox deaths in the Native States. The data only show that a large number of persons were vaccinated in the course of the year.

21. *Jails.*—There is one jail in Ajmere division in which the average number of prisoners was 571, the average daily sick 7, and the deaths 9, yielding a death-rate of 15·75 per 1,000. Of these deaths 3 were from chest complaints, 1 from dysentery, 1 from dropsy, 2 from debility and old age, and 2 from "all other causes." It will be observed that there was no death in Ajmere jail from fever or cholera, a fact which may be contrasted with the 4·89 per 1,000 death-rate from cholera and the 16·17 per 1,000 fever death-rate in Ajmere town.

22. There are 13 jails in the Native States, in which the average prisoners were 3,271, the average daily sick 204, and the deaths 95.

23. The death causes in Native jails are stated in per-centages of the total deaths as follows:—

Death Causes.	Per cent. of Total Deaths.
Malarial fever and spleen	8
Cholera	5
Rheumatism	1
Respiratory diseases	21
Diarrhœa and dysentery	36
All others	29
All causes	100

Two disease groups, those of the respiratory classes, together with diarrhœa and dysentery, caused 57 per cent. of the whole year's mortality, which was 28 per 1,000 of the average prison strength. During the preceding year, 1884, an average strength of 3,020 yielded 136 deaths, or a death-rate of 43 per 1,000, and of this rate 17 per cent. was due to cholera and 10 per cent. to malarial fevers.

24. The Ajmere jail experience contrasts favourably with that of Native jails. It would appear as if the Ajmere prisoners were better clothed and better fed than those of the Native jails, and that the sanitary arrangements generally were better. It is satisfactory to be informed that improvements in Native jails are making progress, and that two new jails were being erected.

25. *Sanitation.*—Under this head it is stated that the arrangements for cleansing the city of Ajmere and removing the refuse by tramway had been completed and were in full working order. The proposed filtered water-supply for the city awaited funds for its completion. The sanitary state of Ajmere, as we have seen, is scarcely satisfactory, and there appear to be some points in the sanitary condition of this city requiring further elucidation.

26. Sanitary improvement appears to excite considerable interest in the Native States, and is advancing with better prospects apparently than in other districts of India. The progress already made "in cleansing cities, improvement of jails, opening dispensaries, as well as in the additional "interest taken in the laws of health generally," has been continued. The Agency Surgeon of Jeypore reports that "the sanitary condition of the district improves wherever the officials take an "interest in the question." The Agency Surgeon of Ulwar, the death-rate for which is returned at 16 per 1,000 on a population of 49,867, informs us that all he has written in previous reports on the "exceeding cleanliness of the city of Ulwar still holds good, and that further efforts at improvement "in this essential work were being made. In the lanes and byeways there was found the same "earnest effort all through to get the town or village into a good sanitary condition." But the reporter advises that stricter attention should be paid to the protection of wells.

The cholera death-rate in Ulwar (·14 per 1,000) was about a fortieth part of the rate in Ajmere town and its suburbs, which exceeded 5·4 per 1,000.

27. A number of other instances are given where similar advances in cleansing have been in progress, and the reporter concluded, nevertheless, that "much, very much, remains to be done, but "enough has been said to show that sanitation is progressing in the Native States of Rajputana." This continued desire of progress is a very satisfactory feature in the case, but it must be added that no such facts regarding improvements, or desire of progress, have as yet reached us from any other Governments in India. Efforts, such as these, on the part of Native rulers to protect their people from the ravages of epidemics are worthy of every encouragement, and we can only express a desire that they may be further developed in Rajputana, and copied in other places.

20th May 1887.

No. 12.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the COMMISSIONERS of the Town of CALCUTTA for 1884–85.

This Report includes nine months of the year 1884 and three months of 1885. The details of work and expenditure are given very fully between these dates, which form the official year. But for sanitary purposes the calendar year alone is used everywhere, and we are glad to find that the calendar year has been again adopted in the Health Officer's report, so that for public health purposes the report is that due for 1884 and not for 1885. We shall proceed to deal with its contents on this view of the case, beginning with the Health Officer's report.

1. The population adopted in calculating the ratios is that of the 1881 census, which was made up of,—

Males - - - - - -	288,817
Females - - - - -	144,402
Total - - - -	433,219

presenting the very unusual feature of the male population being double that of the female. This large difference has never been completely accounted for, although part of it is, no doubt, due to the residences of males seeking employment in Calcutta and entered on the census, being in reality outside municipal limits.

2. Whatever may be the explanation, it is clear that for the birth-rates the whole population cannot be adopted in striking the ratios, and the Officer of Health is obliged to adopt the English proportion of males to females, and by doing so to reduce the child-bearing population to 284,402, on which number the births amounting in 1884 to 8,290 yielded a birth-rate of 29·1 per 1,000. The only remedy for this statistical difficulty, which, to a certain extent, influences the death-rates also, would apparently be to include the suburbs within municipal limits, and have one sanitary and registration agency for the whole population.

As it is highly probable that children are born in the suburbs whose fathers were within municipal limits on the census night, so many deaths taking place in the suburbs among this moving population

may be really due to the operation of local causes within municipal limits. Hence, under present circumstances, it cannot be said that the birth and death rates of municipal Calcutta are other than approximations to the truth.

3. *Deaths.*—The deaths registered in 1884 were of,—

Males	7,938
Females	5,318
Total	13,256

These numbers would give a death-rate on the total census male population of 27·4 per 1,000, and for females of nearly 37 per 1,000. For the conjoint population the rate would be 30·6. But, as will be presently shown, each ward has its own death-rate, and the ward rates, when averaged, raise the mortality to 32·2 per 1,000. It is evident that for a fixed population these numbers cannot all be correct, but the ratio for females would apparently lead us to the conclusion that all, or nearly all, the female deaths due to Calcutta take place within municipal limits, but by no means all the deaths of males, part of which are no doubt credited to the suburbs, where they take place.

4. The following are the ward rates:—

	Death-rates per 1,000.	
	10 Years Average, 1874—1883.	1884.
Average	32·1	32·2
Park Street	11·6	10·6
Waterloo Street	14·1	13·4
Fenwick Bazar	23·1	23·2
Puddopooker	28·7	29·0
Comertolly	29·3	28·8
Burra Bazar	29·7	34·1
Moocheebara	30·1	30·6
Colootollah	32·1	32·5
Jora Bagan	32·2	36·5
Bow Bazar	32·3	31·3
Shampooker	32·7	32·9
Sukeas Street	33·9	33·2
Bamun Bustee	34·2	29·5
Jorasanko	35·0	39·7
Burtollah	35·4	35·1
Taltollah	36·0	35·1
Collingah	38·6	31·5
Hastings	49·6	44·6

One result presented by this table is that, with exceptions in two or three wards, it shows the death-rates to have been nearly constant, ward by ward, for a period of 11 years. But what is of more importance, it proves that there are striking differences in the ward death-rates, and that those differences have been nearly constant. The two lowest death-rates are those of Park Street and Waterloo Street, which are inhabited by Europeans, while the most unhealthy ward is Hastings, where the residents are lascars, coolies, &c. There is one European quarter, Bamun Bustee, which, nevertheless, takes rank with the worst native quarters. No doubt the class of population has an important influence on the death-rates, but the table shows clearly that locality has even greater influence, and the deduction from the facts need scarcely be stated. It is that during these 11 years insanitary conditions have for the most part determined the death-rates.

5. It is important to show what have been the death causes in each of these 11 years, and these are included in the following abstract table:—

Years.	Cholera.	Small-pox.	Fevers.	Diarrhœa and Dysentry.	Other Causes.	Total Deaths.
1874	1,245	120	4,461	1,358	4,343	11,527
1875	1,674	720	5,328	1,579	4,785	14,086
1876	1,851	71	4,361	1,864	4,817	12,964
1877	1,418	67	5,151	1,683	5,385	13,704
1878	1,338	1,495	6,086	2,010	5,467	16,396
1879	1,186	772	4,796	1,516	4,774	13,044
1880	865	114	3,797	1,267	5,698	11,681
1881	1,693	133	3,765	1,491	5,948	13,030
1882	2,240	97	3,618	1,454	5,848	13,177
1883	2,037	73	3,442	1,307	5,466	12,325
1884	2,272	478	3,618	1,209	5,679	13,256

The first result of this table is that the cholera death-rate has largely increased, although by no means to the ratio of years preceding those in the table, and that the rate of 1884 was the highest of the whole period. The small-pox rate appears to be undergoing one of its periodical augmentations. Of late years fever has become a less prominent death cause, as have also bowel diseases. But the

total deaths do not show that the death-rate of the city is decreasing. Since the scarcity year 1878 the rate has rather been on the increase.

6. We shall next discuss the disease history of the year under review, beginning with the assigned death causes, which were as follow :—

Diseases.	Deaths.	
	Total.	Ratios per 1,000.
Cholera	2,272	5·2
Small-pox	478	1·1
Fevers	3,618	8·3
Bowel complaints	1,209	2·8
Injuries	204	0·47
All other causes	5,475	12·73
All causes	13,256	30·60

7. The sanitary history of cholera in Calcutta has presented features of great interest, and we shall abstract the death-rates from this disease for a period of 20 years to show the facts :—

Years.	Cholera Deaths per 1,000.	Years.	Cholera Deaths per 1,000.
1865	11·7	1875	3·8
1866	15·7	1876	4·2
1867	5·2	1877	3·2
1868	9·6	1878	3·0
1869	8·2	1879	2·7
1870	3·5	1880	1·8
1871	1·8	1881	3·9
1872	2·5	1882	5·1
1873	2·5	1883	4·7
1874	2·8	1884	5·2

It will be observed that these ratios show a remarkable decline after the first five years in the series. During this quinquennial period there was no sanitary work properly so called. Water was obtained from foul tanks and wells, there was no drainage, and the subsoil was water-logged with house sewage; but during this period the first step in the way of improvement was being taken in supplying the population with filtered river water, the effect of which on the public health was an immediate and large decrease in the mortality from cholera. The reduction of cholera continued irregularly, and its minimum rate was reached in 1871, when it was 1·8 per 1,000. Since then extensive drainage works have been in progress, but the improvement has not been continuous, although in 1880 the cholera death-rate again attained a minimum of 1·8 per 1,000, but since that year the rate has been increasing until in 1884 it reached 5·2 per 1,000, the highest rate since 1869. It is clear that there must be some cause for this serious augmentation of cholera in the face of a good water-supply and extensive provisions for drainage, and what this cause may be has been a subject of discussion.

8. There are facts at hand to show that, whatever may be the cause or causes of this increase of cholera, the increase affords no reason for suspecting failure in the results of sanitary improvement. The population under sanitary administration and work within municipal limits afforded, as we have seen, a cholera death-rate of 5·2 per 1,000, while the suburban population outside the limits, but immediately adjoining, yielded a rate of 9·6 per 1,000. The Sanitary Officer says truly that the suburban cholera-rate is "practically almost double that of the town," and this is not an occasional but a constant difference. Among the same class of population, and practically in the same topographical position, except that about two-thirds are under sanitary improvement and one-third not, the unimproved area suffers double the loss that falls on the improved area. Here surely is proof sufficient of the saving of life by good sanitary work. But this is not all. The fever death-rate in 1884 was 8·3 per 1,000 in Calcutta and 15·4 per 1,000 outside, and the bowel complaint death-rate, which was 2·8 per 1,000 within municipal limits, was 6·3 in the suburbs, while the total death-rate, which was 30·6 in Calcutta, became 45·2 per 1,000 in the suburbs.

9. It is clear, then, that the real question is not why Calcutta has so high a death-rate, but rather why, after so much efficient work has been done, the rate is not lower, while the cholera-rate shows a disposition to increase. It appears to us that a reply to this question must be sought in the known laws of cholera. It is simply a fact, for example, that the general mortality from cholera over any given area varies greatly from year to year, a fact which includes in it varying death-rates in localities quite independent of local circumstances. Whatever may be the condition of a locality in a cholera country, so long as it continues to be such, the locality may be expected to be occasionally visited by the disease, but on this point experience on the largest scale teaches us that by well known sanitary measures, the incidence of an epidemic may be greatly reduced in fatality, a law which, moreover, is

illustrated by the experience of Calcutta and its suburbs, as well as by that of stations of British and Native troops, and of jails all over India; and a very important consequence results from this law, namely, that the sanitary condition of a population group which might be such as to afford effective protection when a cholera epidemic is of low intensity might not be sufficient under an epidemic of greater force, and the practical conclusion, so far as concerns Indian cholera, is that as long as this pestilence exists the only safety is to be found in unremitting attention to the sanitary state of localities and population groups.

10. A further examination of the facts of the cholera of 1884 brings out clearly the seasonal intensity of cholera as an epidemic, and also its comparative local severity. For this purpose we shall place together the monthly cholera deaths for Calcutta, its suburbs, Nuddea, and the 24 Pergunnahs :—

Months, 1884.	Death-rates per 1,000.			
	Calcutta.	Suburbs.	Nuddea.	24 Pergunnahs.
January	0·99	3·43	2·76	3·60
February	3·54	8·11	1·68	4·92
March	13·46	22·19	10·56	7·32
April	23·46	38·70	37·32	9·12
May	7·83	14·36	10·80	3·36
June	3·57	7·30	0·84	1·32
July	1·49	3·14	0·12	0·72
August	0·80	1·95	0·10	0·48
September	1·21	1·81	0·10	0·24
October	1·35	2·38	0·36	0·48
November	3·15	6·06	2·40	2·52
December	2·16	6·06	2·04	8·28

In this table are contrasted the cholera rates in seasonal intensity and local severity in two crowded town districts and two rural districts within what is practically the same epidemic area. It will be observed that the seasonal intensity follows the same law over the whole area, but that the local severity of the epidemic, at least in 1884, was by no means the same in all parts of it. The town populations suffered much more at the same time than the country populations, a fact which includes the question why they did so. It is no reply to urge the undoubted fact that cholera is more intense in crowded centres than in country districts, for this only throws us back on the question why it should be so, and why certain tracts of the same area suffer so much more from cholera than do others, as the following abstract proves. We have seen how different are the general death-rates in the different wards of Calcutta, and when we come to apply the cholera test we obtain a similar result.

11. In the following table are placed side by side the death-rates per 1,000 from cholera in each section of Calcutta for a period of 10 years and for 1884 :—

Stations.	Cholera Deaths per 1,000.	
	1874 to 1883.	1884.
Park Street	1·2	1·0
Waterloo Street	1·9	2·7
Puddopooker	2·7	3·8
Fenwick Bazar	2·8	3·2
Bamun Bustee	2·8	3·9
Moocheepara	2·9	4·0
Bow Bazar	3·0	3·5
Colootollah	3·3	5·1
Collingha	3·5	3·8
Taltollah	3·6	3·7
Sukea's Street	3·7	5·2
Shampooker	3·8	6·3
Joransanko	4·0	5·4
Burtollah	4·2	6·2
Burra Bazar	4·2	7·9
Jorabagan	4·5	9·0
Coomertolly	4·8	6·6
Hastings	4·8	6·8
Total	3·3	5·3

This table clearly shows that there are death-rates in certain more or less definite proportions from cholera almost constantly present in the same sections, and that the rates vary greatly in different sections of the town, and, moreover, the figures prove that, whether the intensity of cholera as shown by the total ratios be high or low, there is what amounts to a constant difference of mortality in different sections. Now it is quite clear that, the epidemic intensity being the same over the whole city area, there must be some local reasons for these very diversified death-rates. These reasons have to be arrived at by the Officer of Health, and when so discovered the responsibility of dealing with and removing the causes of mortality, so far as they are removable, is placed on the municipal

authorities. It may be said that all this is common knowledge, but in the remembrance of recent discussions it has appeared necessary to recall the facts, which experience has shown to require continued repetition to prevent their being classed with every-day occurrences, and their importance under-estimated.

12. The question of local causation of epidemics in Calcutta is complicated by the fact that account must be taken of the large extent of important sanitary work which has, without doubt, been carried out by the Commissioners. We shall presently see how extensive this work has been. So far as the drainage provisions have dried the subsoil, and the filtered water-supply has been substituted for the foul water of wells and tanks, the local liability to cholera has doubtless been diminished. But suppose that all the requisite drain pipes and water pipes were laid down, should we be justified in assuming that Calcutta had been placed in the best attainable sanitary condition? The reply must be in the negative, for these great and necessary works are only a means to an end. Their final object, as we have stated in former Memoranda, is to enable healthy habitations to be provided for the people, and, until this is done, we have no cause of complaint if cholera invades the city. A detached country village, in its present sanitary state, is proved by every year's experience to be liable to cholera, and Calcutta is mainly composed of villages crowded together in which ordinary cleansing operations are difficult to carry out, and where the subsoil is infiltrated with sewage and foul tank water, and the wells polluted with filth. Neither drain pipes nor water pipes in the main thoroughfares can do much in the way of improvement of public health while such a condition of matters exists.

13. Take, for example, the case of Jorabagan Ward, cited in the Officer of Health's report. This section of Calcutta, with a population of 36,318, yielded an average 10 years' death rate (1874–83) of 32·2 per 1,000, which in 1886 had reached 36·5 per 1,000. Its death-rate from cholera, which had been 4·5 per 1,000 during the same 10 years, had doubled itself to 9 per 1,000 in 1884, so that 25 per cent. of all the years' mortality had been due to cholera. In consequence of this epidemic outbreak the Commissioners directed the Officer of Health to inquire and report on it, and this is what he says:— "I found that the imperfect surface drainage of the ward is the most striking and "important sanitary evil to be met with. This evil prevails to an enormous extent. It exists "everywere throughout the ward. In a large number of places there are no drains at all, or those "which exist are bad, broken, and to a large extent obstructed by rubbish." He divides the drains into—(1) street drains; (2) drains in the pucca houses and house enclosures; (3) drains of bustees, and he continues:—"The street drainage is good, and the gully pits are kept clean and open. The "drains of the second class are as a rule bad, and it would be safe to say that sewage may be found "stagnating in 40 per cent. of them more or less any day. In a small number of the large houses, "perhaps 25 per cent. of the whole, the drainage is all that could be desired. The surface is paved "and the drains are in good order, water-tight, clean, and with a good fall, showing what might be "done if people would only devote more care to the sanitation of dwellings, but in all the rest the "drains are either mere superficial channels, a chain of small cesspools in fact, or they are of faulty "brick masonry, broken and leaky, and nearly always obstructed with house refuse and rubbish of "all sorts. Varying quantities of putrid stagnant sewage may, as a rule, be found in them. As the "drains are frequently broken, and always badly cemented, or not cemented at all, the sewage oozes "and filters through them into the soil beneath the houses and pollutes it to a great extent." After describing similar defects in house drains the reporter says:—"When it is remembered that the "ventilation of the crowded streets and lanes in which these houses abound is most defective, owing "to the close packing of the buildings, and that the noxious effluvia arising from the tainted earth "are not diluted and neutralized by free currents of air, the dangers to health arising from the "saturation of the surface with sewage will be appreciated. The atmosphere in a number of the "large houses is much contaminated. A mouldy excrementitious odour prevails in the lower rooms "and passages, and from them ascends and fills the chambers in the upper stories." Other serious defects are stated, but the account already given is that of a well-defined cholera locality. There is no cause for surprise if cholera attacks the population when their turn comes round, and nevertheless it is stated that, "in the bustees the state of things is still worse. In some parts of them there are "no drains of any description, and the sewage of huts and privies has no means of escape save by "soakage in the earth, or by evaporation into the air."

As a general conclusion, the Officer of Health says that "in the wards where cholera was most "prevalent, the supply of filtered water was least, at any rate it was insufficient to meet the wants of "the people."

14. The only comment which appears to be called for on this explicit statement of localizing causes of cholera is that subsoil pollution unless prevented must necessarily go on increasing. In disease causes of this kind there is no possibility of standing still, and very probably to this fact is due, partly, at least, the tendency in the cholera death-rate to increase in localities, and most markedly so when the epidemic intensity is higher than usual. In fact, so long as cholera is found lingering in any locality, even although there be so few deaths as scarcely to attract attention, and perhaps even to lead to the conclusion that there is no danger of increase, the pestilence may suddenly break out in force at any time when the epidemic itself happens to move over the district in more than ordinary severity. The epidemic is the touchstone which reveals the sanitary state of the locality, and by applying this test it is not difficult to tell from the preceding table where sanitary work of a very fundamental kind is required, while the Officer of Health's notes on Jorabagan indicate very clearly what is the nature of it, not only in that district, but probably in most of the others in the table.

15. The bustees are the chief seats of cholera in Calcutta, but even some of the worst of them may escape for the time, while less unwholesome places may suffer. This, however, is common experience

everywhere, but we may rest assured that the exemption of any one year affords no security against the decimation of the population by cholera in the years which follow. In this matter there is no safety unless the susceptibility to cholera among the people is extinguished by hard sanitary work.

16. The next disease after cholera in a preceding abstract is *small-pox*, from which there were 478 deaths, or 1·1 per 1,000, in 1884. This rate appears to mark one of the periodical augmentations of small-pox, from which disease only 17 deaths took place in 1882 and 73 in 1883. Small-pox is marked by occasional severe outbreaks, followed by several years of low mortality, but on the whole the mortality has been less during the past 10 years than in similar periods in former times.

17. The vaccination establishment consisted of a Deputy Superintendent, an Assistant Superintendent, 24 vaccinators, and one female vaccinator. The average vaccinations during the preceding four years were 6,698, and the re-vaccinations 1,348. In 1884 the numbers had increased to 13,571 vaccinations and 2,092 re-vaccinations. Of the primary vaccinations 13,222 were reported successful, and of the total primary vaccinations 4,365 were performed at ages under one year and 7,577 between the ages of one and six years. As already has been stated, the births in 1884 were 8,290, so that the operations under one year of age were a little more than half the births. The small-pox deaths under one year of age were 59. The vaccination service appears to be increasing in efficiency, and the facts appear to show that during the years which have passed since the sanitary improvement of Calcutta was commenced small-pox deaths have decreased in number, from the diminished severity of the periodical outbreaks.

18. *Fevers.*—The fever history of Calcutta presents points of considerable interest in their relation to the drainage works. When these works were under discussion many years ago, although it was known that everywhere else subsoil drainage had been attended by marked diminution of fever mortality, it was confidently stated that in Calcutta the reverse would be the case, and one of the threatened fevers was enteric fever, in reference to which in 1884 the Officer of Health states that "enteric fever, as in former years, was conspicuous by its absence. Only nine deaths from this "disease (out of 3,618 from fevers) were registered." Enteric fever in India has nothing to do with sewers or drains. It is most frequent and fatal where there are none.

19. But perhaps the most striking and important facts in the Report are those showing the fever mortality in the drained districts of Calcutta in comparison with the rates in undrained areas in the same fever region. To show this contrast we shall abstract the data for 1884, giving the monthly fever death-rates in Calcutta, its undrained suburbs, and in Nuddea and the 24 Pergunnahs, also undrained:—

	Fever Deaths per 1,000.											
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Calcutta - - -	8·97	7·45	8·53	8·28	6·84	6·06	7·14	8·11	9·0	8·61	10·13	11·06
Suburbs - - -	17·80	13·55	12·31	16·22	12·55	10·78	14·55	13·79	14·55	15·17	23·43	21·23
Nuddea - - -	31·20	24·12	30·60	33·0	24·24	21·60	20·28	19·44	28·68	33·12	41·04	42·60
24 Pergunnahs - -	15·72	11·88	12·72	12·0	10·68	8·76	11·04	13·56	12·60	15·96	22·08	22·44

These figures show that the monthly ratios of fever mortality follow the same law of increase over the entire region supplying the data, but the actual mortality within the drained area of Calcutta was greatly less in 1884 than in the undrained parts of it, and in the undrained country districts.

20. The area of Calcutta itself affords an additional illustration of the same fact. Main drainage works had not at the date of this Report been extended to one section of the town, Hastings, and the following ratios of fever deaths show the comparative liability to fever of the town generally and this undrained area of it for the last five years:—

Years.	Fever Deaths per 1,000 of Population.	
	Hastings.	Town in general.
1880 - - - - -	18·6	8·8
1881 - - - - -	20·1	8·6
1882 - - - - -	13·7	8·3
1883 - - - - -	19·1	7·8
1884 - - - - -	15·5	8·3

In a preceding table we have shown the total average annual death-rate in Hastings for a period of 10 years to have been 49·6 per 1,000, and 44·6 per 1,000 in 1884, while the same 10 years average for the whole town had been 32·1, and 32·2 for 1884.

21. The differences in the sanitary conditions in the town generally and in Hastings are described by the Officer of Health as follows:—"Since 1879 there has been a very remarkable and sustained "reduction in the fever mortality of the city. During the years from 1874 to 1879 the average "annual number of deaths was 5,030, in the four succeeding years, 1880 to 1883, the average fell to "3,655, or nearly 1,400 less, and in the past year the total was 3,618. The diminution of mortality "from diseases of this class would appear to keep pace with the extension of the system of under-

" ground sewers, and with the improved surface drainage and reduced soil moisture which follows " the introduction of sewers into undrained localities. Foul cesspools and open drains, which are " little better than chains of cesspools, become obliterated, and house sewage and surface water is " rapidly and inoffensively removed, instead of remaining to stagnate and putrefy on the surface." And with regard to local persistence of fever, he says of Hastings that "it stands at the head of the list, with a mortality of 15·5 per 1,000 against 8·9, the rate of the entire town. The system " of underground drainage has not yet been introduced into this ward. Liquid sewage is collected " into numerous reservoirs, large and small, and removed by means of carts. The method works " badly, and sewage constantly stagnates in the drains, escapes from the reservoirs, and pollutes the " soil. Accordingly, we find that the fever mortality of this small ward maintains a high level from " year to year."

22. The experience afforded by this undrained ward is of great importance to future sanitary work, and we have thought it desirable to put it on record, because, as we are glad to find, there is a prospect of Hastings being drained before long, and we shall watch with interest the results to the public health.

23. We may here add that the deaths registered under the head of "fever" in 1884 included the following classes:—

	Deaths.
Remittent fever - - - - -	2,215
Simple continued fever - - - -	2,377
Enteric fever - - - - -	6

No deaths were registered from intermittent fever, and not a single death was registered from scarlet fever, a fact which has an important bearing on recent theories as to the cause of this disease, seeing that perhaps no city has in times past been so badly provided with the means of ensuring the health of its milch cows and the purity and safety of its milk supplies. This grave sanitary defect is, we believe, in the course of being dealt with at the present time.

24. *Bowel Complaints.*—Under this denomination were registered 639 deaths from dysentery and 570 from diarrhœa. These deaths were under the average, and no account is given of their localities, but it may be safely inferred that they were the same places which are the usual habitats of epidemics.

25. The year's history of these diseases may be summed up briefly as follows:—Of 13,256 deaths which were registered during 1884 there were 7,577, or 57 per cent. of the total mortality, due to endemic and epidemic diseases, while their death-rate amounted to 17·4 per 1,000 out of a rate from all causes of 30·60. We have here the sanitary problem to be dealt with in Calcutta as in every population group in India, and this is simply the mitigation or prevention of epidemic and endemic diseases. Whatever may have been the extent of good sanitary work done, and whatever may have been the saving of life effected by it, there is this great remnant of mitigable or preventible mortality to be met and diminished or removed. It is in this direction that future reduction in the Calcutta death-rate is to be sought. Let the susceptibility to these diseases be diminished, and the general death-rate will immediately fall. But in dealing with it we must never forget that, except in special examples, such high degrees of susceptibility to the action of diseases of this order cannot safely be attributed to the action of single causes, such as defects in drainage, or bad water, for epidemic predisposition is one of the final results of all the life conditions in a given population. It is an indispensable condition in lessening this predisposition that undrained epidemic localities should be drained, and that good water should be provided, but in a long neglected town site like that of Calcutta too much in the way of immediate improvement must not be expected from these measures alone. We are glad to see that this element in the question is fully recognised in the Report under review, but the action which has hitherto been taken on it has been slower than might have been desired. However, as we next proceed to show, a large extent of most important sanitary work has been done. The bulk of the Report is, indeed, occupied by its administrative details, on which we at this distance would scarcely be warranted in expressing an opinion, and all we propose to do is to give a brief summary of improvements and to show their relation to the epidemic history of the year.

26. *Water-supply.*—The demand for filtered water is partly determined by season, and at times the requirements of the population could not be supplied by the class of mains which had been laid down. However, by improvements in distribution and by inspection of fittings, a larger amount of water is now delivered for domestic use than was formerly possible, and the Commissioners have reported that the official year 1884-85 is "the first year since the commencement of the works that " the supply has been steadily maintained at over 8,000,000 gallons, both in daily, monthly, and daily " yearly average." The population to which this supply is distributed, including the population of the port and fort, was about 433,219, giving for each head about 18 gallons per diem. But in practice this amount of water has not been found sufficient, and one of the improvements which had been undertaken is the laying down of a 48-inch water main between Pultah and Tallah. The subsidiary works connected with this great improvement were also under execution, and by the present date they ought to be far advanced towards completion. Other improvements in distributary mains were also in hand.

27. The unfiltered water-supply used for street watering, latrines, &c., which the pumping arrangements could raise to the amount of 400,000 gallons per hour, was not all available, as the pipes could only carry 250,000 gallons at a safe pressure. Larger pipes have therefore to be substituted, and this improvement was in progress at the close of the year.

28. Water is distributed by street hydrants, of which there were 571. There were also 40 ground hydrants for supplying filtered water, and 46 cattle troughs, besides 1,116 ground hydrants for supplying unfiltered water for street watering, &c. For domestic use there were 13,303 ferrules, ranging from $\frac{1}{8}$th of an inch to $1\frac{1}{2}$ inch in diameter. In the course of the year 643 houses were connected with the water mains. It is satisfactory to learn that, whatever may have been the amount of prejudice against the filtered water when first provided, this appears to be fading away under the experience of its benefits.

29. It must not be forgotten, however, that the bustee population was at the time very imperfectly provided for in this respect, and, while bustee improvements and their extent are under consideration, much good might be done by providing the people with filtered water in the meantime. There is every appearance that, before the lapse of much time, Calcutta will be adequately supplied with filtered water for domestic use.

30. *Sewerage and Drainage.*—Up to the end of March there had been constructed 36·77 miles of first and second class brick sewers, and 127·79 miles of third class (pipe) sewers. During the following official year 2·03 miles of pipe sewers were laid down, so that of the original sewerage scheme eight miles of pipe sewers have to be provided, exclusive, however, of four miles which it has been decided to lay down in Hastings and other undrained places.

31. House connexions with street sewers are, as a rule, carried out by house owners through contractors or tradesmen holding a license from the municipality, in conformity with rules and subject to departmental control. Nominally, the house connexions are supervised by the house drainage inspectors, "but," says the Report, "in practice this supervision has hitherto extended but little "beyond the connexions, these being, from a departmental point of view, of greater importance "than the interior drains, as defective connexions would prejudicially affect the street sewers." No one doubts the necessity for having drainage connexions properly made, but suppose they are all properly executed, would the house drainage necessarily be safer to the occupiers? All experience at home has shown us that, between the street connexion and the interior air of the house, there may be dangerous communication, and at present there are voluntary societies formed for the express purpose of seeing that the house drainage is safe, a work which properly belongs to the local authority. Two things are necessary in house drainage: first, the efficient removal of house sewage as soon as it is produced; and, secondly, taking every necessary precaution by trapping and ventilation of sewers and drains, to ensure that the poisonous atmosphere of the sewer system is kept from contaminating the air of houses, courts, or compounds. How necessary such precautions are may be estimated from the fact, that up to the end of the official year 1884-85 there were no fewer than 24,359 premises connected with the street sewers, and the Report states that "The demand for "house drainage generally keeps pace with the construction of public sewers, which supersede the "open ditches and other channels into which the house drains had until then discharged their con-"tents." In the course of the year 112 applications for privy connexions with the drains were received, of which 89 were granted. The house sewage, is, however, mainly collected and removed to the drainage depôts by hand labour and carts, on which a sum of about 15,000*l.* was spent during the year.

32. The need of systematic supervision of house drainage arrangements is, we are glad to see, fully recognized in the present Report. During the official year 30,670 inspections of premises connected with the sewers were made, in 3,287 of which drainage defects were reported.

33. One of the most important drainage improvements in Calcutta has been the draining, filling up, and metalling of the foul pestiferous ditches with which the entire area was formerly more or less traversed. Their obliteration has been rendered possible by the main drainage works. For several years past this work has been in hand, and the Report states that "the progress in this direction has "now overtaken the construction of pipe sewers in the public ditches of the town. The actual "quantity of work done is, therefore, much below the recorded outturn of work during the last two "years, being only 23,392 superficial feet as against 74,921 superficial feet in 1883-84, and 289,304 "during the five quarters covered by the Report in 1882-83." The 29,392 superficial feet of foul pestilential ditch surface converted into healthy drained footway represents the laying down of 7,561 lineal feet of drains.

34. The Calcutta sewers converge at the pumping station near Palmer's Bazaar, the pump well being about 26 feet below the general surface level of Calcutta, whence the sewage is raised into the high level sewer and discharged at the salt lakes. We have already seen that the filtered water-supply averages about 8,000,000 gallons a day, and the unfiltered supply in 1884-5 averaged 1,491,441 gallons per day. If we assume the daily amount of water at 9,500,000 gallons supplied in one way or another within the town area, and if all of it reached the pumping station without loss by soakage or evaporation, this amount ought to represent the daily sum of sewage water raised at the pumping station, but of course the actual quantity would fall short of both water supplies. But the actual amount of sewage raised to a mean height of 9·14 feet was 14,931,737 gallons, or, in round numbers, 15,000,000, a quantity exceeding the total water-supply by $5\frac{1}{2}$ millions of gallons a day

Part of this excess must, we suppose, be attributed to the flushing of the main sewer lines by admitting river water when the river is high enough, but, on the other hand, it is known that the subsoil water-level of the town has been notably lowered since Calcutta was drained, hence the drainage system as a whole has lessened a notorious disease cause, namely, water-logging of the subsoil, besides providing for the removal of the town sewage properly so called.

35. The interception and removal of storm water is separately provided for by works which admit of its being discharged at the salt lake by gravitation. Besides ridding the town surface of floods a large quantity of water must be kept out of the subsoil by this means.

36. Up to the date of this report there had been formed 72 miles 4 furlongs and 108 yards of stone metalled roads, 67 miles 5 furlongs and 382 yards of brick metalled roads, making together 140 miles 1 furlong and 490 yards of formed road surface, besides 32 miles 1 furlong and 36 yards of sewered ditch roads, raising the total road length to 172 miles 2 furlongs and 526 yards, all of which must be placed under the head of sanitary improvement in such an area as is occupied by Calcutta.

37. Among the more important sanitary improvements of the year must be classed the drainage of 9 tanks and the filling up of 33. There is plenty of work in this direction still to do, but progress is being made in rooting out a potent disease cause.

38. Improvement of bustees was also on hand, although in this department of public health work not much has as yet been done. Drainage of bustee lands was also being done more or less.

39. Cattle stalls and markets had also been to a certain extent improved.

40. These facts regarding permanent works abstracted from the Report may be accepted as showing generally the kind of sanitary work which is being carried out by the Commissioners. It would be impossible, without detailed inspection, to estimate precisely their probable sanitary value. We have, however, the fact that a large amount of work has been done in the proper direction, and we can compare with it the disease history of 1884. But before doing so it is necessary to notice the current conservancy work, because the extent of the work and the manner of carrying it on has an important bearing on the fatality of cholera.

41. Cleansing was carried out by 336 carts constantly in use, and the refuse, or at least part of it, is included in 11,146 railway waggon loads which were deposited at the salt lakes. But this quantity does not include road scrapings, nor road detritus removed from gulley pits and sewers which is used for purposes, including tank filling, within the town. The nightsoil is carried to the sewage depôts, where it is passed into the sewers.

42. The cleansing of bustees appears to have been improved under special arrangements made for the purpose.

43. The whole of this work, whether temporary or permanent, ought to show its sanitary results in improved health, and we have seen that the death statistics, although still marking the influence of epidemic intensity prevailing at any given time over the country, exhibit also very decided evidence of lower death-rates, and also of lower death rates in comparison with those prevailing outside the improved municipal area. Of course the question suggests itself, why after so much good work the epidemic death-rates are not lower, and why the cholera-rate has increased?

44. The answer is not far too seek, and is supplied by the facts in the present Report, with which indeed the Municipal Commissioners and their officers appear to be well acquainted. It is a general law of epidemic diseases, especially of cholera, that the average death-rate of a community is made up of local rates of greater or less severity, which in their turn depend on the life conditions of the people in specific localities. These conditions include many things besides those connected with works of water-supply and drainage, perhaps the most important of all being the state of the subsoil and of the house itself. Without draining such localities and giving their inhabitants better water, little of importance can be effected in permanently benefiting their health. But other improvements depending for their success on these fundamental works have to be carried out, and what they are and their nature is well shown in the Officer of Health's report, from which we have quoted above. There has been no failure, but only incomplete results, because the work is not yet complete, and in as far as regards cholera the chief thing required is that the cholera localities, where excessive death-rates tend to raise the general town-rate, be taken in hand and dealt with, especially in the matter of continuous cleansing and drainage. In other words, the cholera death-rate is to be kept down by improvement or removal of bustees, and by town improvements in general, which will besides react on the general death-rate in other directions also.

10th June 1887.

No. 13.

Memorandum of the Army Sanitary Commission on the Administration Report of the Commissioners of the Town of Calcutta for 1885–86.

We received this Report from the India Office after our Memorandum on the Report for 1884–85 had been prepared, and we shall notice it separately, not because it adds materially to the instructive

sanitary details in the preceding Report, but we shall in this way be enabled to show the progress made during the year in the various clssses of sanitary works, and what still requires to be done.

1. Beginning with the vital statistics, we are glad to find that the general death-rate, and also the comparative rates from epidemics, have declined. During the calendar year 1884 the total mortality was represented by 13,256 deaths within the area of municipal Calcutta, equal to a death-rate on the town population of 30·7 per 1,000. In 1885 the registered deaths were 12,707, or 29·3 per 1,000. The unimproved suburban population presented a similar reduction, from 11,389 deaths, or 45·2 per 1,000, in 1884, to 11,267 deaths, or 44·8 per 1,000, in 1885, but it will be observed that the suburban death-rate still maintained its characteristic difference from the municipal rate. In 1884 the suburban rate was 14·7 per 1,000 in excess of the town rate, while in 1885 the excess had increased to 15·5 per 1,000. The deduction from the facts is, of course, that the equalization of these rates for the whole area, municipal and suburban, must be sought in bringing the whole under one efficient sanitary administration.

2. Within the municipal area the same differences in death-rates in different sections to which we have directed attention in our previous Memoranda were found to exist in 1885. It will be sufficient to abstract the extreme rates for two sections to show this fact. Thus in Park Street the death-rate, which was 10·6 per 1,000 in 1884, had risen to 16·7 per 1,000 in 1885, and the rate of Hastings section, which was 44·6 per 1,000 in 1884, had risen to 45·8 per 1,000 in 1885. The investigation of the causes of these very different rates in sections of the same area, and the means of equalizing them, are among the duties of the Municipal Commissioners and their officers.

3. We shall next contrast the death causes of the town and suburbs for the two years :—

Death Causes.	Death-rates per 1,000.		Deaths per 1,000 in Suburbs, 1885.
	1884.	1885.	
Cholera	5·2	3·7	7·4
Small-pox	1·1	0·36	0·27
Fevers	8·3	8·84	16·30
Bowel complaints	2·8	3·82	8·30
Injuries	0·47	12·58	12·30
All other causes	12·73		
All causes	30·60	29·30	44·8

The difference between the death-rate of the two years was thus due to diminution of cholera in its epidemic form, which more than accounted for the difference. But the suburbs still showed about a double liability to epidemic predisposition among the people. As was the case in 1884, there was not a single death from scarlet fever in the year under review.

4. *Town Improvements.*—We shall next give a very brief digest of the voluminous information under this head. A list is given of 38 bustees which have been "taken up" for improvement. Of these 13 had been completed at the end of the year, improvements in 2 had been commenced, 4 projects of improvement had been approved but not commenced, 4 others were before the Committee, 2 were ordered for report, 8 had been reported on by medical officers. Under this improvement are included opening up bustees, new roads, and other general works. Additional funds were to be provided for accelerating this most important work.

5. Thirty-six tanks had been filled up, or were in the process of being filled up, in the course of the year. A large number of bathing platforms with water-supply had been provided, and had been taken advantage of by 62,000 bathers per diem. A number of roads had been made or widened.

6. *Water-supply.*—Arrangements were in progress for carrying out the increased supply of filtered water for Calcutta and its suburbs. During the official year 1885–86, 13,820 ferrules for house purposes were in use.

7. We may here add the analysis of Calcutta hydrant water, showing its average constitution for the official year 1885–86 :—

RESULTS of ANALYSIS represented in parts per 100,000.

Total solid impurity		15·70
Organic carbon		0·078
„ nitrogen		0·036
Ammonia		None.
Nitrogen as nitrates or nitrites		0·010
Total combined nitrogen		0·046
Chlorine		0·71
Hardness	Temporary	1·61
	Permanent	2·09
	Total	3·70

The character of the water has been subject to the usual conditions of the state of the river and the filters at the time of analysis. But there can be no doubt of the general excellence of the water-supply.

8. *Drainage.*—Under this head the very satisfactory statement is made that "the drainage works "in the town, with the exception of the special area of Bang Bazaar and Hastings Ward, are "virtually completed." The Hastings works were almost finished at the close of the year, and those for Bang Bazaar had been sanctioned. The rest of the town drainage work "was almost entirely "limited to sewering with six-inch pipes most of the remaining open ditches, and then filling them "up and converting them into footpaths."

9. The question of house connexions stood as follows :—

Total premises in town - - - -	33,969
Connected with sewers - - - -	22,482

There is a staff of drainage inspectors to see to the working of the house connexions, and out of 4,701 connected premises defects were found in no fewer than 1,070, and the required steps were taken for repairs.

10. "The storm water outfall works which were completed at the end of 1884–85 have worked "well and successfully during the year."

11. The provision of roads up to the end of the year stood as follows :—

—	Miles.
Roads, stone metalled - - - -	72·52
Roads, brick metalled - - - -	69·85
Sewered ditches - - - - -	33·34
Total - - - -	175·71

12. The conservancy arrangements were carried out as usual.

13. Among other improvements may be noticed the advances made in tree planting; 67 streets had been planted with 4,756 trees, of which 752 had been installed during the year.

14. We have in the preceding paragraphs given a very brief summary of the present state of sanitary work generally in municipal Calcutta. The extent and importance of this work cannot be denied, and as we have pointed out in our preceding Memorandum the results are clearly shown in the reduced general death-rates. The prevalence of epidemics, especially of cholera, and the localized character of the death-rates clearly point to insanitary conditions in special localities as presenting the problems now to be grappled with. So far as can be ascertained from the Reports these are of two kinds, those, namely, connected with constant supervision of works already executed, and those requiring the execution and maintenance of new works. Both have been dealt with in our former Memoranda, but as they have been referred to in recent Health Officers' reports, we shall conclude this memorandum with the following statement of them.

15. The Health Officer of the municipality specifies certain matters in which he considers improvement in the sanitary administration of the city to be specially necessary. We cannot attempt a particular criticism of these recommendations, nor are we informed as to the extent to which they have been subsequently carried out. It is enough to state that, so long as the evils at which the proposals of the Health Officer are directed continue unabated, the high ratios prevalent in certain parts of Calcutta, and the persistent presence of cholera, are fully explained.

16. The first matter to which the Health Officer refers is the flushing of the drains in the groups of huts known in Calcutta as "bustees." "None of the drains in bustees," he says, "have any "appliances for flushing." If this be so, some part, at least, of the high death-rates in these places would be accounted for. Experience has shown that the sewers in Calcutta become, in the absence of continual flushing, largely charged with deposit, and this result in an eastern climate cannot but be highly prejudicial to a population crowded densely in low huts in the immediate vicinity of the drains.

17. Another of the Health Officer's recommendations is that the public bathing platform be supplied with pure water. At present we understand that they are furnished with the unfiltered water of the river. An adequate provision of these public bathing places, and their supply with filtered water, has been repeatedly urged on the Corporation by the Local and Supreme Governments as a reform of pressing importance. It is a matter of regret that this great improvement is still so far from completion. We entirely concur in the view of the Government, that the means of ablution should be brought within reach of the entire city population, a result which, judging from the comparatively small numbers of bathers mentioned, we fear is far from achieved at present. Equally important is it that the water supplied at these places should be of a pure character. The Commissioners observe that the execution of the contemplated plan of supplying the bathing places with filtered water has not yet been carried out "owing to the delay in the provision of an increased "supply due to want of funds." We are impressed by the serious character alike of the result and of the cause alleged to explain it. The public supply, for the purpose of bathers, of unfiltered water from a source so impure as the Hoogly at Calcutta, the banks of which are crowded with manu-

factories and crowded villages, and into which the entire liquid sewage of the Fort still, we understand, finds its way, cannot but be a serious danger to the public health. But this is only one effect of a far more serious evil, the general inadequacy of the filtered water-supply.

It is admitted in the reports that many parts—and those the lowest and most predisposed from their general condition, to disease—are still without filtered water, and are dependent on the foul tanks for water for drinking, cooking, washing of utensils, and personal ablution. The inadequacy of the supply in many parts of the town has long been notorious; in the suburbs it is wholly wanting and to this cause among others no doubt, much of the large excess in the death-rates of the suburbs over the town is attributable. The Commissioners explain the delay in providing an adequate supply by difficulties in raising the funds necessary for the completion of the work. We are not in a position to criticise the adequacy of this apology; we can only point out that, so long as many portions of the native town and the whole of the suburbs are left with a water-supply of the most impure and dangerous character, an important source of disease and mortality is left unabated, and a wholly unnecessary loss of life is every year incurred. We trust that effectual means may be adopted for carrying out this all-important reform without further delay.

18. Another of the Health Officer's recommendations is that the foul tanks and wells, with which the city still abounds, be filled up with earth excavated from the new docks. The existence of large pools of putrid filth in the immediate vicinity of the people's dwellings is, we have no doubt, a powerful agent for evil, especially when, as appears to be the habitual practice in Calcutta, they are resorted to for all domestic purposes, and at the same time are in many cases the receptacles of all surface drainage. The water of some of these places has been ascertained by official analysis to be more impure than average London sewage. If the bad tanks of Calcutta can be filled up with pure material, a sensible improvement in the health of the surrounding localities may be looked for. But any departure from this rule is likely to be followed by unfavourable results. If unwholesome putrefying material be employed the consequences may be most serious; the strictest rules on the subject should be prescribed to the officials concerned, and a careful supervision exercised in order to guard against departure from the principle of keeping the subsoil as free as possible from substances which may at any time prove a powerful agent of unhealthiness.

When pure material cannot be obtained, and in all cases where a large and wholesome body of water is available, the plan might be tried of reclaiming the tank, fencing it off from public access, planting its sides with turf, and supplying it with the oxygenising vegetation which exercises so powerful an influence in the purification of water. A tank so reclaimed would at any rate secure an open and airy space, which in the crowded portions of Calcutta is an important consideration; and the risk of a poisoned subsoil would be obviated.

19. Another matter to which the Health Officer refers is the ventilation of the sewers. "The "present sewer ventilators are," he says, "a source of very great nuisance, not only to the passers-by "but to the houses in the vicinity. The stench which issues from them is sometimes overpowering."

These facts would seem to justify the inference either that the construction of the drains is defective, or that they are not kept properly flushed and free from deposit, and that the means of ventilation are inadequate. Both these defects, if they are still unremedied in Calcutta, are calculated to produce injurious results to the public health. Putrefaction proceeds with great rapidity in an eastern climate, and the numerous and important variations of temperature favour the giving off of gases which are dangerous to human life. The Health Officer, indeed, observes that a boy had been recently killed by inhaling such gases. There is good ground for supposing that the sewers of Calcutta have been in past times suffered to lapse into a dangerous condition, that flushing was neglected, and that, indeed, the means for adequate flushing as a necessary part of the sewerage have never been supplied.

We have no means of knowing how far these defects have been remedied, and we can, therefore, only observe that unless the drains are properly flushed and kept perfectly free from deposit and other obstruction, and thoroughly ventilated, they can scarcely fail to be a serious source of evil to the population; and we observe that the special Commissioners appointed, a few years ago, by the Lieutenant-Governor, to examine into the sanitary condition of Calcutta, recorded the opinion that the condition of the sewers had, in fact, tended to lower the general level of public health. A more emphatic condemnation could scarcely be pronounced, and we trust that this serious evil has ere now been adequately dealt with.

20. Another point of great importance is that the means of severance of the drains from private residences should be complete and efficient. We observe that the provision of public inspectors of this branch of sanitation in Calcutta is inadequate, and that in cases where inspection did take place, the condition of 20 per cent. of the connections was found to be defective. The subject deserves serious attention.

21. The only other of the Health Officer's recommendations which we think it necessary to notice is the improvement in the sheds in which cattle and milch cows are kept, a subject to which we have often called attention. Besides which we are informed that there is no sort of supervision of milk supply in Calcutta, that adulteration to the extent of 25 per cent. is openly practised, and that this adulteration is practised with the water of tanks into which excreta find their way, and in which persons bathe, and foul clothes are washed. It will be observed that these are matters of ordinary public health detail, many more of which could be taken from past reports, and they all point to the absolute necessity of placing the entire sanitary administration of Calcutta on a footing of technical knowledge and experience. We earnestly trust that, in the legislation on which we understand the Local Government to be now engaged, effectual means will be taken for securing these advantages.

22. The Government of India has, on more than one occasion, urged upon the municipality the duty of fully utilizing their powers of taxation, and sparing no effort till certain well-ascertained causes of disease are removed. We regret to observe that the municipality had not in the year under report complied with this recommendation, and that the house-rate and water-rates are still levied at rates considerably below the maximum. This is the more to be regretted, as it appears that the value of property in Calcutta has of late been greatly enchanced; the Commissioners mention that the valuation of house property during the last 25 years has increased from 85 lacs to 141, an increase which they estimate to be equivalent at 20 years' purchase to a capital increase of no less than 11 crores of rupees. The owners of property in Calcutta accordingly would appear to be without excuse in refusing to incur the burthen necessary to remove the great causes of disease which have been so clearly ascertained and so urgently pressed on their attention. They must remember that, in the words of the Calcutta Health Society's report, "Public opinion in England and India will not allow "the Government of India to go on much longer leaving the sanitary condition of every city in the "empire in the deplorable condition which now prevails," and that they may be compelled by superior authority to fulfil their duties to their fellow-citizens.

6th September 1887.

No. 14.

Memorandum of the Army Sanitary Commission on the Administration Report of the Municipal Commissioner of Bombay for 1885–86.

The present Report, like those which have preceded it, contains a large amount of information on works of various kinds, completed or in progress, in the Bombay municipality during the official year, including details of public health works and measures, which latter we propose to notice briefly in the following paragraphs.

1. The population used in calculating most of the ratios in this Report is that of the census of 1881, which was returned at 773,196. But there has no doubt been a considerable increase since then, and Bombay, like Calcutta, appears to have its numbers added to by a large changing and migratory population, besides the increase due to the resident population.

2. The recorded births for the last three years have been as follows :—

1883	15,182
1884	14,637
1885	14,964

The birth-rate on the census population would thus be 19·35 per 1,000, but on the calculated increase since 1881 the rate would fall to 17·72 per 1,000, or about half the birth-rate in London. There appears to be little doubt that an explanation of such birth-rates as these are must be sought in defective registration.

3. *Deaths.*—The registered deaths for the last five years have been :—

1881	21,856
1882	20,468
1883	23,530
1884	22,542
1885	21,850

The death-rate in 1885 was for—

	Per 1,000.
Males	24·58
Females	33·80

or a total of 25·88 per 1,000 for the population of both sexes. Considering what has been the past sanitary history of Bombay we should scarcely be warranted in accepting 25·88 per 1,000 as the true death-rate. The rate moreover varies greatly in different localities. We have, for example, the "Water division," with a death-rate of 3¼ per 1,000; Fort Southern, with one of 8¼ per 1,000; Byculla, with a rate of 30·88; First Nagpada, with one of 37·02; Second Nagpada, with a rate of 40·18; and Chuckla, with one of 41·02 per 1,000. It is true that district rates in towns vary greatly according to locality, but when these comparatively high rates, and there are several others, are compared with the low general rate of 25·88, there is reason to suspect that the deaths are not all reported. This is merely suggested as a possible explanation of a death-rate which by no means corresponds to the past sanitary condition of the people. A large part of the death-rate falls on infants and children under five years of age. We have seen that the total deaths in 1885 were 21,850, and of this number 9,760, or nearly 45 per cent., were under five years of age, a result which is partly attributed by the Officer of Health to the high density of the Bombay population in the poorer localities. Of deaths registered at all ages in 1885, 10,731 were from among persons born in Bombay and 10,910 among those born elsewhere, leaving 209 deaths for which the facts could not be ascertained. As already has been stated, Bombay has a large immigrant and moving population, a fact which renders accuracy in vital statistics very difficult of attainment.

4. *Causes of Death.*—The following abstract gives the assigned death causes for 1885:—

Death Causes.	Number of Deaths.	Deaths per 1,000 of Population.
Small-pox	55	·06
Measles	423	·51
Fever*	6,648	7·87
Cholera	598	·71
Phthisis	2,905	3·44
Diseases of nervous system	2,242	2·65
Diseases of respiratory system	3,787	4·49
Diarrhœa	937	1·11
Dysentery	608	·72
Accidents	330	·39
All other causes	3,317	3·93
All causes	21,850	25·88

* The Report gives full statistical details on the causes of death, and the fatal fevers are classed as follows :—

Enteric fever	10 deaths.
Simple continued	1,171 „
Ague	281 „
Remittent fevers	5,186 „
Total	6,648

The ratios in this table are calculated on the 1881 census, to which the assumed increase of population has been added.

5. With reference to the remark already made as to the want of correspondence between the general death-rate of the city and the sanitary state of localities, it is only fair to the municipal authorities to compare the death-rates from the diseases in this abstract and the village rates, so far as we have the means of doing so. These are as follow. In 1885 the cholera death-rate in the city was 0·71 per 1,000, and in the villages affected and unaffected the rate was 2·27 per 1,000, or above threefold. But as deaths from this epidemic disease were returned from 3,733 villages out of 40,894, it follows that if Bombay city be classed as an affected locality in the same sense as each of the villages which suffered was an affected locality, its death-rate would be not a third, but less than a thirtieth of the village rate.

In the same way we find that the village death-rate from bowel complaints taken over all of them, affected and unaffected, was 2·78 per 1,000. But, as only a fifth part of them suffered, the real rate would be nearly 14 per 1,000. The Bombay city rate was 1·83 per 1,000, or about one-seventh of the affected village rate.

The country small-pox death-rate was ·16 per 1,000 all over, but for the affected villages, less than a fortieth part of the whole number, the rate would be about 6½ per 1,000, while the Bombay city rate was ·06 per 1,000.

If we take the fever death-rate the contrast is equally striking. The Bombay city rate for diseases so classed was 7·87 per 1,000, while the village fever-rate was 19·74 per 1,000, but, as the returns refer to 28,216 villages only, the death-rate of country localities affected would average about 28 per 1,000.

6. Whatever modifications these figures would have to undergo under a more accurate system of registration and diagnosis, the differences are sufficiently great to justify our making the comparison, and from this it follows that, whatever defects there may still be in the sanitary arrangements of the city itself, it has done work to which nothing analogous has been done in the country villages, for we have here a dense population of 800,000 enjoying (for India) a comparative immunity from epidemic diseases which, neither the small isolated country population groups, nor the other municipal towns, have at all approached to.

7. So far as regards the villages, the facts for the city show that effective sanitary work against epidemic diseases can be done even in the face of grave difficulties, and it is scarcely necessary to draw the conclusion that no corresponding work has been done for the village populations, on the maintaining of whose health and working power the prosperity of the country mainly depends. This result has been arrived at after about a quarter of a century of professed village sanitary work, and our obvious duty is to call attention to the facts.

8. There is one group of diseases in the preceding abstract table for which the country returns afford no corresponding data. These are phthisis and respiratory diseases, from the former of which 2,905 deaths were registered in 1885, and from the latter 3,787 deaths. The reputed mortality from phthisis was 3·44 per 1,000, and from respiratory diseases 4·49 per 1,000, together representing a death-rate of 7·93 per 1,000, equal to the conjoined mortality from fever and cholera. Of respiratory diseases 1,347 were registered as acute bronchitis, 1,121 as chronic bronchitis, 328 as asthma, and 874 as pneumonia. It is impossible to say how many of these fatal chest cases may have been tubercular in character, or whether some of the cases of phthisis ought not to have been classed under other heads. But in discussing the influence of locality on chest diseases, as apart from climatic and personal causes, we may deal with the reputed death-rate from phthisis and its causes, and this brings before us the question of locality in relation to death-rates.

9. In Bombay, as in all large cities, there is no uniform rate covering the whole population. Every large population group presents different death-rates, varying also in their proportions from different diseases in different localities, and in each locality prevailing diseases and deaths are related to the classes, habits, and relative ages of the inhabitants, as well as to local conditions. The following are the death-rates per 1,000 in each locality presented by the Bombay mortality statistics for the chief diseases in 1885 :—

Districts.	Cholera.	Small-pox.	Fevers.	Phthisis, highest Rates.
Upper Colaba	·34	—	3·48	—
Middle and Lower Colaba	·63	—	7·21	—
Fort, Southern	1·99	—	·85	—
Fort, Northern	·17	·02	7·06	—
Esplanade	·53	—	4·20	—
Market	·99	·06	6·73	—
Mandvi	·77	·14	11·12	4·27
Chuckla	·62	·02	12·06	8·85
Oomarkhari	·76	·03	8·56	5·61
Dongri	·51	·03	10·54	—
D'hobi Talao	·98	·15	8·70	—
Fanaswadi	1·55	·04	5·85	—
Bhuleswar	·91	·02	9·49	5·90
Khara Talao	·55	·13	10·63	6·13
Kumbharwada	·71	·22	9·17	—
Khetwadi	·23	·23	7·60	—
Girgam	1·10	·11	7·93	4·62
Chaupati	·18	—	5·83	—
Walkeshwar	·35	—	4·33	—
Mahalakshmi	·16	—	6·57	—
Mazagon	·17	·03	7·41	—
Tarwadi	1·30	—	6·60	—
Second Nagpada	·37	·06	11·99	7·66
Kamathipura	1·08	·03	11·87	4·99
Tardeo	·78	·19	7·64	—
Byculla	·81	·07	9·65	—
First Nagpada	·53	·10	9·28	—
Parel	·32	—	13·09	—
Sewri	·54	—	12·60	—
Sion	·05	·05	7·07	—
Mahim	1·84	—	9·70	—
Worli	1·29	—	9·98	—
Water division	1·44	—	·76	—

10. It will be observed from this table that, low as was the general death-rate from cholera in 1885, none of the districts escaped the disease, and that the relative death-rates varied greatly, proving the influence of locality, even where the severity of the epidemic was by no means great on any part of the area. In sanitary work the question is suggested why part of the area of Bombay returned cholera death-rates of between 1 and 2 per 1,000, while many lower death-rates near at hand showed that in the most severely affected portions of the area the higher death-rates could scarcely be attributed to epidemic severity.

11. Next, as regards small-pox, it can scarcely be said that in 1885 this disease was epidemic nevertheless, there are similar questions suggested by the total exemption of certain areas while their neighbours suffered.

12. Of the 6,648 deaths assigned to fevers, no fewer than 4,764 were registered as remittents, and 422 as remittent fevers with fatal complications, 281 were intermittents, 1,171 were continued fevers. There were besides these 10 deaths from enteric fever; and two other fevers, cerebro-spinal and relapsing fever, yielded one death each. Now the district table shows that these fevers were fatal in very different degrees in different parts of the city, and that for every fever death in one district there were from 10 to 15 in another. According to sanitary experience these differences ought to suggest local causes, and practically that the sanitary improver should be at work in the localities where the figures show his presence to be most required.

13. The statistics of phthisis yield similar local results, for the rates in the table are not all the rates, but only the higher ones, and these are so great that they almost look like ordinary epidemic rates, some of which are reproduced year after year in the mortuary tables for the same localities.

14. There can be little doubt, as the Officer of Health points out, that one of the main factors in these various district rates is density of population on surface areas, and within dwelling-houses. Relative density of population means dwellings crowded together so as to obstruct needful circulation of air, and increase of filth and refuse on small surface areas, increasing air pollution in otherwise stagnant air. It includes, besides this, increase of fouled domestic water in the subsoil from want of drainage, and hence for a dense population there is little chance of escape from the necessary consequences of that density. The acknowledged remedy everywhere lies in town improvements by removal of buildings and opening up of roads and spaces, and to such improvements are to a great extent due improved health in large cities where they have been carried out. Much may, no doubt, be done by constant cleansing and by drainage works to improve bad localities, but it is not always possible to do work of this kind effectively at a moderate outlay on localities where the surface

crowding is so great and the means of access so deficient that even ordinary cleansing operations can only be carried out with difficulty if at all.

15. This aspect of the question is understood in Bombay, and to a certain exte[illegible] it is being acted on, but as the subject is one of great importance we shall quote what the Officer of Health says about it:—"The density of population in the most dense section of London is less than the density in any "of the 12 most densely crowded sections in Bombay, representing a population of 420,566, and "which have 458·57 persons to an acre. . . . . The minimum of house population in any one "district is apparently higher than the maximum in London." In the most densely peopled part of Bombay the density is 759 to an acre, or less than 6½ square yards to each. Another element in the question is the rapid increase of the population, for it appears that in the 10 years 1872–81 the population per house had risen from 20 to 25. We have in former Memoranda directed attention to this point of increasing crowding, and it is obviously one which must be dealt with by the municipal authorities, for every year's delay adds in a high ratio to the difficulties attending it.

16. The report contains no such detailed information as to the sanitary state of districts as would enable us to account for the death-rates and their diversities in the districts, but we can learn from the different departmental reports the progress which was made in sanitary improvements during the year.

17. Sundry improvements had been carried out at the Lovegrove sewage pumping stations. There had been difficulty in obtaining tenders for house connexions with the sewers, but trial works were to be undertaken to obtain experience as to the cost. Main sewerage works had been extended, and it is satisfactory to learn that application had been received for making connexions with the houses along the sewer lines. The actual length of sewers of various kinds laid down in the course of the year was very considerable, and those lines which are intended for house drainage are not to receive or carry storm water, which is being otherwise provided for. As the Municipal Commissioner considers that we had misunderstood his remarks on the intention of house connexions, it may be as well to rectify this matter. In the present Report he says:—It has been repeatedly explained that "what are somewhat misleadingly termed 'house connexions' form an inseparable feature of the new "system, that is, there must be some channel, means, or appliance, by whatever name it is called, "which will conduct polluted water or excrementitious matter from the premises where the pollution "occurs to the nearest sewer, and it is subject to the condition that, while it is provided with proper "methods of ventilation to prevent danger or nuisance, it *must not* have such openings or be so "situated as to allow of the admission of any appreciable quantity of rain-water to the sewers." (This is one of the necessary conditions of the "separate" system.) "These connexions may be made to "serve for the removal of sullage, or excrement, or of both."

In the Bombay Municipal Report for 1883–84, to which our remarks applied, the Commissioner says that "the great object to achieve for the sanitary improvement of the city is to carry off "polluted water or house sullage by means of new sewers"; and, further, "provided there be an "efficient system for the speedy removal of nightsoil, it matters little (except from a financial point of view) whether the system be 'wet' or 'dry.' The latter is, at present at any rate, more in accord "with the customs and ideas of the inhabitants, but for the removal of sewage, other than nightsoil, the "duty of proceeding at once with a complete system of drainage cannot be too strongly insisted "on." It will be observed that in this statement of the case, keeping the house sullage removal separate from excrementitious matter, to be otherwise removed, is not objected to, while in the Report under review the house connexions may be used for both purposes. Hence we had not "curiously misunderstood" the case, and all that it appears necessary to repeat is that in a large densely peopled city, such as we have shown Bombay to be, any attempt at "dry" removal of household filth would most certainly end in a state of matters by no means likely to improve the public health, and that wherever there is water at hand, together with house connexions, drains, sewers, and a suitable outlet, there is no alternative, for all the means are at hand for the immediate cleansing of houses. This must be a continuous operation at a rate of not less than 3 feet per second. At Frankfort-on-the-Maine the sewers and drains for 60,000 people discharge the excreta and foul water from the most distant point to the outlet which for half a mile has only a fall of 1 in 1,000 within 1½ hour. Our remarks on the 1883–84 Report, as well as those we have just made, are intended to enforce this fundamental sanitary principle in city improvements. In the case of villages and small towns other cleansing arrangements may be adopted to suit local circumstances.

18. Satisfactory progress appears to have been made in disposing of the rainfall by separate sewers and a rain-water reservoir and sluices, and the Municipal Commissioner states that places which were formerly knee-deep in water after a comparatively moderate fall of rain are now dry in a very short space of time.

19. In addition to the partial adoption of drains, the cleansing operations of the city of Bombay were carried out by an average number of 3,804 men, 585 scavengering and drain cleaning carts, and 140 nightsoil and cesspool carts in daily use. The amount of garbage collected and removed was 393·6 tons per day, and of nightsoil 337·8 tons per day. No less than 204·6 miles of covered drains were opened and cleansed in the course of the year. Essentially, therefore, the entire cleansing of the city was done by hand labour and carts.

If the halalkhor cess income represents the expenditure incurred in removing nightsoil, it would appear that a sum of 31,000*l.* was spent on this service in the official year 1885–86.

As the works of drainage and sewerage are now making progress it is unnecessary to refer to the subject further at present.

20. *Water-supply.*—Water was supplied from Vehar and Tulsi lakes in the course of the year by 14,448 house connexions, 46 dipping wells, 56 drinking fountains, 24 stand-pipes, 14 large ornamental fountains, [illegible] troughs, and generally the water-supply had been extended. A new 24-inch iron main had been laid from the Vehar lake, and the filter beds at Vehar had been completed. Bhandarwada waterworks appear to have been completed, and also the reservoir and filter works on Malabar Hill. An additional water-supply from Tansa was under consideration.

21. Under the head of "Cholera," in the Officer of Health's Report, he gives the following additional facts on the relation of this disease to the water supply. Of people using water from Vehar and Tulsi lakes 589 were attacked with cholera and 465 died, and of persons using well-water 94 were attacked and 71 died. Of the lake-water drinkers 78·8 per cent. died, and of the well water drinkers 75·5 died, results in direct contradiction to the presumed specific action of cholera polluted water in spreading the disease.

22. We have limited our remarks solely to public health works in progress, but the municipal authorities have been active in providing gardens and spaces for recreation, which will influence beneficially the health of the vast population of the city.

23. We now know that within a few years the drainage and water-supply will have been completed, and when advantage has been taken of these works for effecting their main object, which is house cleansing, we may expect to have much lower disease and death-rates, with better working power in the population. There will be little reason to complain, as at present, of street nuisances when facilities for avoiding them have been provided for the houses.

24. But when all is done there will be ample scope for town improvements properly so called, and which ought to be carried out as far as practicable concurrently with drainage and water-supply works, for just as these are calculated to remove causes of air pollution, so better house construction supplies an equally important element in lessening the risk of air stagnation. On this subject the Officer of Health makes some important remarks, which we would commend to the consideration of the municipality. He says:—"The influences hostile to vitality, the impurities arising out of this concentration, "can only be resisted and overcome by breathing spaces around and within each building, and by "channels to rapidly and safely carry away the liquid refuse of the population. . . . But most "unfortunately for the adoption of measures for the protection of the population in the dense districts, "of buildings most crowded, from poisoning as certain as if fatal vapours were administered, the "municipal law is impotent to help. The impotency of the law bearing on buildings is now so well "understood that efforts to enforce demands which cannot be legally enforced only diminish such "influence as may in a friendly way be brought to bear." Viewed from the side of public health requirements, this statement means that the municipal law, without loss of time, and to avoid large future outlay, should be amended in this particular.

In conclusion. We need scarcely repeat what we have so often said, that it cannot but be subject of regret that executive sanitary measures have proceeded so slowly in Bombay, but nevertheless they are making progress, and their completion may be said to be within sight. But the municipal work has another importance, in that up to the present it has considerably reduced the mortality from epidemics which, in other municipalities and in the country villages, have in the absence of effective sanitary work been left year after year to inflict great loss and suffering upon the people. And these results have been attained in perhaps the most unfavourable population group to deal with in the whole Presidency, and in one of the most densely peopled cities anywhere to be met with. Surely it is time for the country populations to be dealt with, and their interests in these matters protected.

28th May 1887.

No. 15.

Memorandum of the Army Sanitary Commission on Sanitary Reports of the Health of British Troops in the Madras Command during 1885.

Two reports on this subject have been separately referred to us. The earlier one, addressed by the Surgeon-General to the Secretary to the Government, Military Department, and the other, which is in most respects similar, with observations on the Surgeon-General's recommendations by the Adjutant-General, is also addressed to Secretary to Government. It does not appear to be necessary to consider these reports on two separate Memoranda. We shall therefore deal with them together.

1. The strength of British troops in the Madras command for the year under review averaged 10,414 non-commissioned officers and men.

2. From among this number there were 12,105 admissions to hospital, 97 deaths, and 251 men were invalided home. The ratios per 1,000 strength compared with those of the preceding 10 years were as follow:—

—	1875–84.	1885.
Admissions per 1,000 - -	1,172·66	1,162·38
Deaths „ „ - -	14·62	9·31
Invalided „ „ - -	38·04	24·10

Considering these ratios solely from the side of total loss to the Service during these 11 years, it will be seen that, counting together the deaths and invalids for each period, the average annual disappearance of men from the ranks during the 10 years 1875–84 was in the ratio of 52·66 per 1,000, and in 1885 it had fallen to 33·41 per 1,000, a decided mark of improved health and efficiency, notwithstanding the slight increase of 0·71 per 1,000 in the death rate of 1885 over the rate of 1884.

3. The average number of men constantly sick in the force was 686. This is the least favourable feature in the year's statistics, and now that the death-rates have been so far reduced it may be suggested whether it would not be advantageous to direct attention to this point. Unfortunately, nearly one-third of the constantly sick, or 221 per 1,000, were in hospital for venereal diseases, an inefficiency cause which the measures hitherto tried have failed to diminish.

4. Of other causes more under the influence of sanitary control, the febrile disease group kept 60 men and the digestive disease group 118 men constantly on the sick list. To these three disease groups was due considerably more than one-half of all the constantly sick in 1885. They were the means of keeping 399 men out of the ranks out of 10,414.

5. The following were the principal death-causes in 1885 :—

Diseases.	Deaths.	Deaths per 1,000 Strength.
Enteric fever	23	2·21
Tubercular diseases	9	0·86
Nervous system	9	0·86
Circulatory system	7	0·67
Digestive system	19	1·83
Injuries	16	1·53

It will be observed that cholera is not included in this abstract. In Madras Presidency there was only one death from it at Secunderabad, yielding a death-rate of 0·095 per 1,000, a degree of immunity which may be contrasted with the 58,109 deaths among the civil population of Madras Presidency itself. Their death-rate was 2·0 per 1,000, or nearly 22 times that of the European Army. There was another death from cholera at Tonghoo, in Burma. Taking the deaths in order, the most fatal disease of the year was enteric fever, from which there were 73 admissions, 23 deaths, and one invalid. During the preceding year, 1884, there were 129 cases and 18 deaths from this disease.

6. The following were the stations where troops suffered from enteric fever :—

——	Cases.	Deaths.
Secunderabad	29	10
Bangalore	18	1
Bellary	8	2
Cannanore	—	2
Wellington	—	2
St. Thomas Mt.	—	1
Belgaum	—	1
Sitabuldi	—	1
Calicut	—	1
Kamptee	3	—
Rangoon	—	1
Thyet Myo	—	1

The enteric fever admissions are not given for all the stations, but the first three stations in the list yielded 45 cases out of a total of 73 in the command, and 13 out of 23 deaths.

7. The local conditions under which enteric fever continues to show itself at Secunderabad and Bangalore have not received further elucidation in the present Report. There are, indeed, the usual differences of opinion on the subject. It is thought by one medical officer that the Ulsoor tank and its water are not to be blamed solely, because enteric fever occurs where it is not used, and also in barracks out of reach of its emanations. But if this be admitted it would only show that enteric fever does not depend on a single cause. Again, it is stated that difference of level in the tank water shows no change in the statistics of this fever. But it may be suggested that, from the nature of the case, the observations have been too few to justify such a conclusion. In questions of etiology it scarcely helps us to assign such a disease as enteric fever to any one cause. Several causes, including age and climate, may co-operate, and the proper function of skilled sanitary investigation is to assign due weight to each, and decide what can be done to abate or remove them. Facts already ascertained, and again referred to by the Surgeon-General, such as the defective surface drainage of the barracks at Secunderabad, and the proximity of part of the barracks at Bangalore to a crowded Native bazaar, may have influenced unfavourably the health of troops at these stations; and we know from other reports that there are disease causes at Secunderabad in the vicinity of the staff lines which require removal. And Bangalore has not yet obtained a wholesome water-supply.

Trees were planted as a protection at Secunderabad in the course of the year, and the barracks at Bangalore are reported in good condition. But this view can scarcely be accepted regarding any

Indian barrack if we adopt the facts stated by Colonel Burton, R.E., who says:—"(1) The men in "all the barracks live on stone floors, in several places raised less than 12 inches above the ground, "and rarely more than 24 inches above the ground; (2) that none of the barrack floors are damp "proof; (3) that all the rain-water falling from the roofs soaks into the ground equally under the "barrack floors as in the surrounding ground, owing to the absence of efficient surface gutters "round each barrack by which such water might be led away." (Military Department, 19th February 1887, No. 1011, Sanitary.)

We have called attention year after year to these grave defects in barrack construction, and in any discussion of the causes of enteric fever they must be taken into account.

Under these local circumstances, we must either consider that some of the 47 enteric fever cases at these two stations may not have been true enteric fever, or that there are still causes in operation which predispose to this more severe fever form. The fever admissions at both stations are high. At Bangalore they amounted in 1885 to 111·16 per 1,000, and at Secunderabad to 139·07 per 1,000. Even these ratios are not high when compared with the amount of fever in the Nagpore force, which includes troops at Kamptee. In this division 1,032 men sent 383 cases of fever to hospital, equal to a ratio of 371·13 per 1,000. Four of the Nagpore cases and one death were due to enteric fever. These statistical facts show the presence of sources of malaria at the stations, but they could scarcely account for enteric fever. At most they would act as predisposing causes.

8. Evidence in the present and past Reports appear to justify a recommendation that the general sanitary condition of Secunderabad should be examined and remedies applied, that Bangalore should have its improved water-supply provided as speedily as possible, and that the Native bazaar near the barracks should be maintained in a good sanitary condition, while the well-known subsoil malarial causes at Kamptee should be dealt with. As the case stands, that is all we should be warranted by the present Reports in advising.

Some additional light on localization of enteric fever may possibly be obtained from a fact regarding part of a regiment which was sent from Madras to Port Blair. The South Welsh Borderers were stationed at Fort St. George, and a detachment from them, together with other troops for Burma, was embarked at Madras. There was no enteric fever among troops at Fort St. George, or among the troops embarked for Burma. But in the detachment landed at Port Blair there were four cases of this fever. There is strong evidence in this instance that local conditions had something to do with the occurrence, and this appears to be the view held by the Surgeon-General.

9. Diseases included under the head of *Digestive system* yielded a large amount of sickness. There were received into hospital under this class 567 admissions from dysentery, of which 4 died, 430 admissions from diarrhœa, none fatal, and 307 admissions and 12 deaths from hepatitis, including abscess of liver. There has been some reduction in death-rates from these diseases of late years. But there is no information in the Report as to their causes, and we must therefore repeat what has been the result of past evidence, that hepatic disease may be induced by drink, as well as by climatic causes,—the first can be controlled, and the latter may be mitigated by attention to clothing; that bad water, where it is used, predisposes to dysentery as well as to other bowel diseases; and that a known cause of dysenteric attacks is exposure to cold blasts of air in bed at nights. As related to the possible influence of intemperate habits, it may be stated that there were 29 admissions from delirium tremens, 6 from alcoholic poisoning with 1 death, and 14 admissions and 4 deaths from sunstroke.

10. The chief practical result of the present year's Report is that it shows great prevalence of local causes of malarial fevers, probably arising from general malarial conditions, partly from climatic causes and want of attention on the part of troops to clothing, and partly from undrained subsoil of stations, with all of which the predisposition to enteric fever may be connected. In former Reports the state of latrine accommodation was included among the probable predisposing causes of this fever, and we learn from the Reports under review that at Kamptee the dry-earth latrines are not so well managed as they might be. From the few facts presented to us we can only give general indications as to remedial measures, and they appear to be those which are well known and acknowledged, such as general sanitary improvement of stations, particularly in such cases as Secunderabad and Bangalore, scrupulous attention to the water-supply of troops, and such works and measures as will cleanse the subsoil of stations generally and diminish malaria. These, with attention to the habits of the men, so far as we can learn from the present Report, would be the most effectual means of advancing the improved standard of health which has been attained at many Madras stations in late years. It is true, as the Adjutant-General states in his remarks, that questions of finance present grave difficulties to the progress of sanitary work, but of these we cannot take account. We concur generally in the proposals of the Surgeon-General, and, as a general rule of sanitary procedure, those stations where fatal fevers are most prevalent ought to be first improved, although the required expenditure may have to be diverted from works at the less unhealthy stations.

28th May 1887.

No. 16.

Memorandum of the Army Sanitary Commission on the Medical History of the European Troops in the Bombay Command for 1885.

1. The trooping service during the period between 7th October 1885 and the 11th April 1886 was carried out by the usual troop and other ships, and there were in all 19 outward voyages in the course of the season.

2. The aggregate numbers on board ship were of officers 732, ladies 164, children 115. Of troops there were embarked in health 17,671 men, of women 503, of children 675, and 35 female servants. There were 40 horses carried outwards in 10 of the voyages.

3. Two tables of admissions and deaths are given, and by adding them together we find that during the voyages there were 1,538 admissions to hospital, of which 383 were from primary syphilis, 28 from secondary syphilis, and 357 from gonorrhœa, 768 in all, or just one half the admissions from all causes, showing, apparently, that undeveloped cases had been embarked at the outports. There were no fewer than 117 cases of itch admitted. There were two cases and one death from enteric fever on board the "Malabar," and a fatal enteric fever case on board the "Jumna." There was a fatal case of rheumatism on board the "Serapis," and a fatal case of pneumonia on board the same ship.

4. During the season there were 13 return voyages, and on board the ships there were 496 officers, 138 ladies, and 166 children. Of troops in health there were 6,219 men, 398 women, and 974 children, and of invalids there were 1,338 men, 119 women, and 287 children. There were also 21 female servants, 86 insanes, and 154 convicts and bad characters returned. The sanitary state of the ships is stated to have been "satisfactory."

5. *British Troops in the Bombay Command.*—The disease and mortality statistics, if taken over the whole command, including Quetta, were most unfavourable, as shown in the following abstract:—

Average strength, 1885		=	11,650
Admissions	17,005	=	1,471·1 per 1,000
Deaths	280	=	24·03 „
Constantly sick		=	67·00 „
Invalided home	338	=	29·01 „

But, as the conditions of Quetta are peculiar, and will have to be dealt with apart from those of the Bombay stations generally, it will be better to separate them in this Memorandum.

6. Deducting the average strength, admissions, and deaths due to Quetta from the rates due to other stations, the Bombay stational rates would stand as follow:—

Admissions per 1,000	1,338
Deaths per 1,000	14·5

and for Quetta the rate would be—

Admissions per 1,000	2,289·1
Deaths per 1,000	85·23

The last item exceeded the preceding 10 years' average by nearly 60 per 1,000. It is clear that such an excessive death-rate would needlessly complicate the entire Bombay problem. But, even after this deduction, it can scarcely be said that the Bombay rates are altogether satisfactory, or that the present Report contains any adequate assignment of their causes.

7. As usually happens, the ratios of sickness and mortality vary greatly at different stations, a fact shown in the next abstract, which also exhibits the rates for a period of 11 years:—

Districts.	Ratios per 1,000 Strength.			
	1885.		1875—1885.	
	Admissions.	Deaths.	Admissions.	Deaths.
Colaba	1,005·5	13·64	1,846·8	16·20
Deolali	1,452·1	19·18	1,331·8	20·15
Belgaum	860·8	9·02	1,165·6	8·39
Aden	1,164·1	15·50	983·6	13·51
Karachi	1,682·2	22·00	1,962·8	19·05
Hyderabad	2,196·1	9·69	1,610·8	11·70
Poona	1,359·0	12·41	1,578·3	11·92
Kirkee	1,307·4	15·18	1,550·3	12·45
Ahmadnagar	1,488·0	2·18	1,694·8	14·31
Satara	1,265·2	7·81	1,573·9	6·68
Kolhapur	1,519·2	19·23	1,342·2	12·57
Mhow	1,254·3	10·20	1,845·9	10·44
Nasirabad	1,464·4	10·84	1,752·5	24·17
Neemuch	2,149·9	17·29	2,267·7	20·23
Asirgarh	1,804·9	8·13	1,758·1	14·89
Indore	1,957·4	31·91	2,042·4	15·37
Ahmedabad	1,771·4	8·16	1,853·5	19·97
Deesa	1,048·0	23·98	1,311·1	12·35

Few of these stational ratios can be accepted as affording reliable data for judging of the health of troops, on account of the small numbers of men at most of them. There are only two of them, Poona and Mhow, at which the numbers exceed 1,000, and in each case the death-rates are under the average for the Bombay Army as a whole. The evidence against the smaller stations rather consists in persistently high death-rates, such, for example, as those of Neemuch, in which 374 men yielded a year's death-rate of 17·29 and a 10 years' average of 20·23 per 1,000, and Nasirabad, where 646 men yielded a 10 years' rate of 24·17 per 1,000, although in this case the rate of 1885 was 10·84 per 1,000. Viewed in this way the table affords useful indications of the relative sanitary condition of stations, and where improvements are most needed; but in considering this question it

is, of course, necessary to ascertain the causes of death, as the death-rates at individual stations are imainly dependent on the greater or less prevalence of diseases of the endemic and epidemic class.

8. The following abstract shows briefly the chief diseases which influenced Army efficiency in 1885 :—

Diseases.	Including Quetta.		Excluding Quetta.	
	Admissions.	Deaths.	Admissions.	Deaths.
Enteric fever	88	30	74	26
Continued fevers	1,326	4	1,234	—
Paroxysmal fevers	5,246	12	3,339	5
Cholera	131	85	14	10
Rheumatism	318	—	245	—
Primary syphilis	1,150	—	1,031	—
Secondary syphilis	290	1	239	—
Tubercular diseases	93	12	82	10
Respiratory diseases	476	22	315	10
Digestive diseases	2,249	57	1,745	25
All causes	17,005	280	13,433	142

It is necessary to add to this abstract that the strength at Quetta averaged 1,619 non-commissioned officers and men, while the strength at the stations, excluding Quetta, but including sanitaria and troops on march, amounted to 10,031. We shall discuss the year's facts regarding Quetta separately, but, in the meantime, we shall follow the course of these diseases at each of the stations in continuation of our remarks in former Memoranda.

9. And first as regards enteric fever, from which at the Bombay stations there were 74 admissions and 26 deaths in 1885. There are certain facts regarding enteric fever which may be considered as of a fundamental character, at least in India. These are its relation to the soldier's age and period of service in the country. All other things being equal, it may be taken for granted that a young army with short periods of service will always yield a high death-rate from this fatal disease. The next fact is that, whatever difficulty there may be in the diagnosis of enteric fever cases at their appearance, the disease is enteric fever and nothing else. One Deputy Surgeon-General says that "there is not a shadow of doubt that the disease here is exactly the same as in Europe."

10. If we assume a tolerably average distribution of young soldiers over the Bombay stations we are met at once with the question, if this be the fact, how happens it that the prevalence of enteric fever varies so much at different stations, as the following five years' abstract shows :—

Stations.	Strength.	1881 to 1885.		1885.	
		Admissions.	Deaths.	Admissions.	Deaths.
Colaba	733	16	7	1	1
Deolali	365	4	—	3	—
Belgaum	776	13	7	7	4
Aden	774	7	3	—	—
Karachi	818	80	10	19	4
Hyderabad	416	1	—	—	—
Poona	1,128	29	15	8	5
Ahmednagar	459	19	2	1	—
Mhow	1,274	20	12	5	3
Nasirabad	646	34	16	10	4
Neemuch	347	8	1	1	—
Asirgarh	123	1	—	1	—
Indore	94	5	2	1	1
Tarragarh	—	4	1	3	—
Deesa	417	20	7	14	4
Baroda	—	2	1	—	—

This table presents sanitary data of a different kind from those connected with age, periods of service, or personal habits. There are stations at which the disease may be said to exert little influence on the mortality, while there are others at which enteric fever is the most important death cause.

11. Attempts have long been made, both in this country and in India, to trace the initial steps in its etiology, but it cannot be said that, up to the present time, any real progress has been made in the inquiry. The presumption is that the varying death-rates in the table have something to do with local conditions, and it is certain that at several stations those conditions are such as are usually coincident with the presence of endemic or epidemic diseases, but this is about all that can be said. What these conditions are can only be matter of observation, and, as will be seen from the following examples given by medical officers, local predisposing conditions are not difficult to discover in some instances, while in others such does not appear to have been the case.

12. For example, "*Belgaum* returned seven cases and four deaths. Although a careful examination was made, no insanitary conditions were discoverable which could account for the occurrence of the disease." It is worthy of remark that, apart from these fever cases, Belgaum is one of the healthiest stations in the Presidency.

13. On the other hand, take Karachi, which, during the last five years yielded 80 cases and 10 deaths from this fever. Of this case the Surgeon-General says that "the disease is endemic in "the city of Karachi, and is due in a great measure to the cesspool system in vogue there. The "atmosphere, the water (which, though supplied by the pipes to the city, is still distributed by the "old primitive methods to the barracks), the milk, and all articles of diet are necessarily liable to "contamination." We are glad to learn that since this Report was written water has been laid on to the barracks, so that we shall now learn how far impure water has been a factor in the past enteric fever history of this station. But sufficient is known of the past sanitary history of Karachi to render it doubtful if laying on pure water will of itself prevent the disease, for unless means are adopted for removing the used water by drainage it may act as an added disease cause. There is, besides, sufficient information available to render it doubtful whether anything short of removing the troops to a more healthy site will be of much use.

There is no doubt, as the Deputy Surgeon-General states, that "this condition of things is a "standing reproach, and inquiries and suggestions are alike thrown away if recognized sanitary "improvements are not at once carried out."

14. At Poona, where during the last five years 29 men have been attacked and 15 have died of enteric fever, of which 8 cases and 5 deaths took place in 1885, the Medical Officer states that "in "none of the 8 cases could the origin of the disease be traced to any particular insanitary cause, "either in or near the barracks or from other sources." And yet the regiment had to be removed from the barracks "on account of the anæmie appearance of the men, and the general feeling of "depression prevailing throughout the corps." If this regiment was stationed in Ghorpuri barracks, whose radical defects in position and construction have been long known, there was cause for fever.

15. We shall take another case, Nasirabad, where in 1885 there were 10 cases and 4 deaths from enteric fever. Now it has been long known that at this station there have been causes in operation, mainly connected with the state of the subsoil, which elsewhere have been found related to this fever. It is needless to say that these causes have not been dealt with in the way of remedy. In all such cases the difficulty to ordinary observers not always on the spot is that the fever only shows itself occasionally, but this is the customary history of the whole tribe of diseases, and, besides, an Indian station is only an undrained town, and nobody now-a-days expects an undrained town to be free of epidemics, although they may appear only at intervals of time. One of the objects of town drainage is to obtain a dry subsoil and dry houses and house floors, and, although in very few reports has the state of barrack floors been alleged as an enteric fever cause, still there is one notable case, that of Bangalore, in Madras, which may be cited on account of the independent testimony it adduces to the importance of this element of health.

16. In former Memoranda we have often discussed the relation of enteric fever at Bangalore to the use of foul water from the Ulsoor tank, a subject which has long engaged the attention of the Government, and in papers (Government of Madras, Military Department, 19th February 1887, Sanitary,) which we have received is a paper by Colonel W. H. Burton, R.E., Superintending Engineer, V Circle, on the state of the barracks. It is not necessary that we should discuss the water question at present; but the facts stated by Colonel Burton appear to have so important a bearing on the enteric fever question generally that they merit grave attention. He says, "in my "opinion the sickness among the troops may, in some measure, be due to the following:—(1.) The "men in all the barracks live on stone floors, in several places raised less than 12 inches above the "ground, and rarely more than 24 inches above the ground. (2.) That none of the barrack floors "are damp proof. (3.) That all the rainwater falling from the roofs soaks into the ground equally "under the barrack floors as in the surrounding ground, owing to the absence of efficient surface "gutters round each barrack, by which such water might be led away." Now, here we have in this independent statement by an officer of Royal Engineers of certain conditions under and around the Bangalore barracks, described, so far as we remember for the first time, which are well known predisposing causes of fever in hot climates. Given a barrack with a damp floor we may look for fever.

17. We have quoted the Bangalore case merely to direct attention to the condition of barrack room floors, where enteric fever may have appeared without apparent cause; but we must repeat what we have often stated, that none of the single causes on which so much reliance was formerly placed in this country are likely to solve the etiolgical question in India. For example, this fever was in many cases so obviously connected with filth that many years ago it received the appellation of "filth fever." Yet it is certain that both in India and England enteric fever appears where no appreciable filth cause is present. Again it has been described as a sewer fever, and yet it is most common in India where there are no sewers. In default of more evident causation, enteric fever has been attributed to diseased milk; nevertheless, in India European women and children who use milk as they would do at home, all but escape the disease, while soldiers, who use milk very sparingly, if at all, are the chief sufferers. Of course, with such varied experience, the question naturally suggests itself as to what practical course should be taken, and the answer must be that diminution of this fever, as of other epidemic and endemic diseases, must be sought, not in this or that remedy but in the persistent sanitary improvement of stations. Without personal examination and inquiry it would be impossible to range the causes according to their importance, but it can safely be affirmed that enough of a general character is revealed year after year in the station reports to show that there is scarcely a station in India where subsoil conditions favourable to epidemics are not to be found, or where the surrounding population groups are not living under insanitary conditions hazardous to the health of young soldiers frequenting them.

18. *Cholera.*—The next most fatal disease in 1885 was cholera, from which there were 14 admission and 10 deaths at the Bombay stations. Including deaths at Quetta and among troops on the march

131 men were attacked and 85 died, so that the stations suffered comparatively little. The attacked stations were :—

—	Admissions.	Deaths.
Deolali	1	1
Belgaum	1	1
Karachi	2	1
Mhow	3	2
Neemuch	4	2
Indore	1	1
Khundwa	2	2
	14	10

Among troops on the march there were 14 cases and 8 deaths. The report contains no information as to the local predisposing causes of cholera.

So far as concerns sanitary relations, the chief interest of the report centres in the disease enteric fever, and as we have already discussed the information regarding it contained in the report it does not appear to be necessary to enter more into the details of the year's disease history.

19. *Quetta.*—The present year's Report adds considerably to our knowledge of the local causes which have made this station so remarkable for its recent unhealthiness. In 1885 the facts for Quetta alone and exclusive of those supplied by other troops in the district were as follows :—

Average strength	-	1,129
Admissions	-	2,702 = 2,393 per 1,000.
Deaths	-	117 = 103·6 „

The chief admission and death causes were as follows :—

—	Cases.	Deaths.
Cholera	103	63
Enteric fever	14	4
Remittents	13	3
Ague	1,434	—
Other fevers	20	—
Lung diseases	140	11
Abdominal diseases	366	29

20. The cholera of 1885 was an erratic epidemic covering a large area, so that troops which had been moved from an infected locality for safety met with it while on the march. Its point of departure was Rindli, in the Dadar Plain, two miles to the east of the Bolan, "the terminal station at the time " of the branch railway from Sibi and the depôt of an immense number of transport and commissariat " followers and animals, as well as of vast quantities of grain and stores, all collected in anticipation " of a war in Central Asia. After spreading widely at Rindli the epidemic advanced up the pass, " attacking every post in succession, and reaching Mach, 45 miles off, on the 24th May. On the " 3rd June the first case among the troops in the Quetta valley occurred in the 43rd Oxfordshire " Regiment, then encamped close to the eastern hills on a spot about a mile from cantonments. " Other cases quickly followed in the same regiment, and subsequently the disease appeared among " the men in barracks and station hospital. The Rindli epidemic spread northward as well as " westward up the Bolan, and developed most extensively in the Hurnai route among the railway coolies, " 1,400 having perished according to official estimate. Ascending towards Pishin, it intercepted the " troops marching across the route on their way to the Zairat range to the standing sanitarium " camp," whither they had been despatched from the Quetta cholera.

21. This appears to us to be a very interesting account of the origin and movement of an epidemic of cholera. But to render the history complete we should require to know what were the sanitary arrangements in force at Rindli, how they were carried out, and who was in charge of them. From past histories we know that cholera has moved from India up the Bolan Pass, and has been met in it by marching troops, but in this instance we have apparently a vast encampment of men and animals near the mouth of the pass, on which the disease first swooped down before it began to move. Rindli was, in fact, the centre from which cholera moved in various directions. Obviously the key to the whole case must be sought in the sanitary precautions taken or neglected to be taken at the time at Rindli. It would scarcely answer in the present day to pass over such a case without rigid inquiry. We have no information even as to the cholera deaths which occurred at Rindli encampment.

22. Movement of troops from Quetta was the precaution adopted, but the whole country appears to have been under the epidemic, for six cases and two deaths from cholera took place among men who had been removed to a distance of 15 miles from Quetta and at an elevation of 7,150 feet above sea level.

23. In a former Memorandum we discussed the peculiar climate of Quetta with reference to disease prevalence, and it will be sufficient to state that the real outbreak of epidemics took place in June, when the temperatures were high, with great changes between day and night. Climate was clearly an important factor in the disease history. At Quetta all the cholera deaths took place between June and October, and the four deaths from enteric fever, and three deaths from remittents, took place after the beginning of August.

24. In former Memoranda we have called attention to the defective local topography of Quetta, and in the present Report there are some additional points of information which appear to be of importance. The following is one of these:—"On the immediate north-east of the valley there is an "immense catchment mountain area, the outlet of which is a narrow pass about 400 feet higher than "Quetta. Through this floods rush, and would inundate the station were they not guided into the "main waterways previously mentioned." Have we not in this single topographical fact some explanation of the large prevalence of paroxysmal fevers in the apparent absence of the usual Indian fever conditions? The waterways alluded to are partly natural and partly artificial, and their object is to prevent flooding of the station. But the question may be suggested whether a locality where precautions of this kind were necessary was a suitable one for a military station. The barrack accommodation is being improved, but, taking into consideration the current disease history, perhaps the best course to follow is the one which has apparently been decided on, namely, to reduce the Quetta garrison, and to remove part of the troops to a new and better selected station.

25. As regards the Presidency stations apart from Quetta, their sanitary condition and requirements have been so long known that it is scarcely necessary to discuss them. If we had no other information about them except that supplied by the disease and death statistics, we should have quite enough to prove how much requires to be done at most of them to render their occupation safe for troops.

The one recommendation that appears to be necessary is to make use of the ample information in possession of the authorities, and to press forward the sanitary improvement of stations without further delay.

No. 17.

Memorandum of the Army Sanitary Commission on Papers relating to Fairs and Festivals held in the Madras Presidency during the year 1885.

1. In 1885 cholera prevailed to a considerable extent in Madras Presidency, and 58,109 people died of it. It showed its presence in 201 out of 230 circles of registration, and 7,385 villages out of 51,978 suffered. Every month yielded deaths, but the disease was most prevalent during the first six months of the year. Out of 76 towns all were attacked except three. The death-rate for the country population was 1·9 per 1,000, for the towns it was 3·3 per 1,000, and for the provinces generally the rate was 2 per 1,000, or just double the previous five years' average.

2. There are 22 districts in Madras Presidency, and under the circumstances stated 73 fairs and festivals were held in 16 of them. The numbers present are not stated for 23 of the gatherings, but at 50 of them the visitors were estimated at 1,094,676. Probably no fewer than two millions of people were present at all of them.

3. The usual sanitary precautions were adopted at the places where the fairs were held. These consisted in cleansing measures, carried out in small places by the people themselves, or aided by an additional cleansing staff, protection of water sources, and the orderly conduct of the fairs.

At 70 of the fairs the sanitary measures are described as having been "good," "satisfactory," or "sufficient." The facts for two places are not stated, and the arrangements at one place are described as "not good."

4. Properly speaking, there was no outbreak of cholera at any of the fairs, but the facts as stated in the reports were as follows. Out of 73 fairs 66 had no cholera. The seven instances at which the disease was present mainly in the vicinity are given as follows:—

5. *Thaipudam* festival was held at Palni on 28th January to 6th February. In Palni itself there were 24 deaths, or 1·8 per 1,000, from cholera. The report states, "There was cholera prevalent in "the town and the adjacent village since November 1884. But it did not increase in virulence "owing to the concourse of people during the festival."

6. *Tiruvalur* festival was held during March. In Tanjore, within which this festival was held, there were 5,077 deaths from cholera, a death-rate of 2·3 per 1,000 out of a population of 2,129,538. "Cholera was prevalent in the station and its vicinity during the festival to some extent. There "were altogether 23 cases treated in the dispensary during the festival, and of these 9 proved fatal." The source of these cases is not stated. It is not said that they took place among pilgrims, or how many of them. They were, from the context, station cases.

7. *Badrachalam.*—This fair was held between the 25th and 29th March. "Early in March, cholera "being very prevalent in some of the villages in the vicinity of Badrachalam," a notification in the District Gazette Extraordinary of 9th March was published, warning the intending pilgrims of the risk they would run in visiting the place, and hence the number of pilgrims who attended the festival was comparatively very small. "During the month of March there were 94 people attacked with "cholera, of whom 44 died in Badrachalam. Cholera seems to have increased very little on account "of the festival." The numbers present are given at 7,000, and the festival was held in Godaveri district, in which 6,012 people, or 3·3 per 1,000, against a previous five years' average rate of 0·02 per 1,000, died of cholera. There were 937 villages out of 2,249, or above 40 per cent., attacked. This festival was hence held in a cholera district during a severe epidemic without any special risk. The deaths appear to have been mainly village deaths, and due to the local epidemic before the assemblage.

8. *Kumbakonum.*—This festival was attended by 75,000 people, and was held in Tanjore, which for some years had been the seat of a severe cholera visitation. Its five years' cholera death-rate had averaged 4 per 1,000, and in 1885 it was 2·3 per 1,000, and 26 per cent. of its villages suffered. The cholera of 1885 in this district was a continuation of the cholera of 1884, and the festival was held between the 19th and 28th of February. On this last day a pilgrim was attacked and died, and a constable subsequently. The cases are not given in detail, but, judged by the ratios, these would be very small indeed for the district mortality.

9. *Siddhavattam.*—Only about 2,000 people were present at this assemblage, and they escaped cholera, while 50 deaths took place in the adjacent village. But these occurred about four months before the festival.

10. *Ponoor* festival, in Kistna, afforded a similar case. There were 1,500 people present, and there was no cholera, but the epidemic broke out in the town and lasted two months, during which time there were 218 cases and 77 deaths, and when the pilgrims arrived there was no re-appearance of the disease.

11. Besides these instances there was a Roman Catholic gathering at Velangani, in Tanjore, at which 12,000 people were present, and two of them died of cholera; but no details are given.

12. We have given the facts as they are stated in the reports, and they amount to another year's experience of almost total exemption from cholera at fairs and festivals in cholera infested districts, where the only precautions adopted were cleansing and water protection. But the experience would be incomplete without reference were made to examples of great assemblages under sanitary control where there was no cholera. For example, the great Congeveram festival, at which 286,676 people were present, had no cholera, although the district, Chingleput, yielded 862 deaths in 159 attacked villages. Dola festival, in Ganjam, where 60,000 people assembled, had no cholera, while the district itself lost 3,322 people. In the same way 40,000 pilgrims at Kottapakonda, in Kistna, escaped cholera, while the district lost 4,800 people. Again, the Mylar festivals, which were attended by 33,000 and 12,260 people, escaped; and in Cuddapah district 411 people died.

13. These are merely samples taken from the fairs where efficient sanitary work was done, and where cholera was warded off, although prevailing all round in the districts. There is nothing new in the facts, which are a mere repetition of those supplied by the experience of previous years. And we can only repeat what we have often said before, that the conditions of cleanliness, water protection, and general sanitary regulations, which are attainable at these festivals are all attainable in villages, with this important exception, however, that whereas in these festival areas all that in most instances is required is to prevent subsoil pollutions for the time; the village work includes the removal of the results of long continued neglect of sanitary rules as well as present protection from filth and bad water. These fair and festival reports are now a standing protest against village sanitary negligence.

28th May 1887.

No. 18.

Memorandum of the Army Sanitary Commission on Fairs and Festivals held within the Madras Presidency during the year 1886.

1. The Reports on these festivals are restricted solely to the local facts, and we have no means of comparing these with the corresponding facts for the 20 districts within which the fairs were held, as the Madras Presidency Report for 1886 has not yet been received.

We can therefore only deal with the statistical evidence in the Reports, which, as will be seen, is nevertheless of great importance to sanitary work.

2. The festivals described in the Reports are 91 in number. The pilgrims present at them are only given for 56 localities, and they amounted at these to above 2¼ millions.

3. The sanitary precautions adopted were of the usual kind. There were specially provided latrines, sweepers, and carts for cleansing. Domestic water-sources were more or less protected from contamination, and overcrowding was as far as possible avoided, with one significant failure, itself of great importance.

4. With scarcely an exception, the surface work appears to have been well done. There was not much to complain of about the water. Some details pointed out by the Acting Sanitary Commissioner in certain cases might be amended with advantage, but in nearly every instance the precautions adopted were sufficient for sanitary purposes, as is shown not only by the accounts of them in the Reports, but by the very striking nature of the results.

5. At 90 fairs and festivals there was no cholera. Why, then, did the 91st festival suffer? This exceptional case was at Bhadrachalam, in Godaveri district, where cholera had been prevalent for the last two years. The town itself had accommodation for its own population of 2,000, while the added pilgrim population of 20,000, arriving from a cholera affected district, and consequently all more or less predisposed to cholera, were crowded into the houses. We know, besides, that other sanitary

evils would ensue from the usual consequences of pilgrim crowds without sufficient means of cleansing. It need excite no surprise that under such circumstances there were 20 deaths from cholera.

6. We know not how many people died of cholera in the towns and villages in the districts, but we do know that in all probability some three millions of people, by the adoption of simple sanitary rules, escaped cholera altogether. It required, apparently, the exceptional case of Bhadrachalam to prove the rule, by affording a very striking illustration of the great danger of overcrowding during cholera periods.

Lastly. The practical result of the year's experience is to show the nature of sanitary measures to be adopted against cholera in the towns and villages of Madras, and it is high time that the village populations were dealt with on such principles, as to secure to those remaining at home an immunity from cholera similar to that afforded to those who went on pilgrimage in 1886.

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REPORT

ON

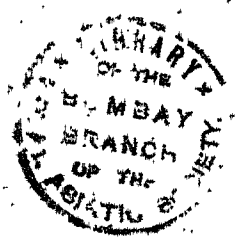
SANITARY MEASURES IN INDIA IN 1886-7:

TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1888.

VOL. XX.

Presented to both Houses of Parliament by Command of Her Majesty.



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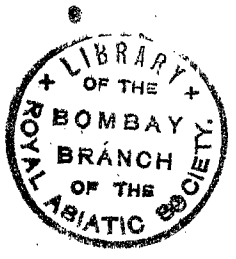

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CONTENTS.

REPORT.

	Page
I. European Army:	
Sickness and mortality in 1886	1
Cholera	2
Small-pox	3
Fevers	3
Bowel complaints	3
Venereal diseases	3
Invaliding	4
II. Native Army:	
Sickness and mortality in 1886	5
Bengal	5
Madras	7
Bombay	7
III. General Population:	
Mortality from chief diseases	8
Bengal	8
Madras	9
Bombay	10
Punjab	11
North-Western Provinces and Oudh	11
Central Provinces	12
Berar	13
Assam	13
Lower Burma	14
IV. Jails:	
Sickness and mortality in 1886	15
Bengal	15
Madras	16
Bombay	16
Punjab	17
North-Western Provinces and Oudh	17
Central Provinces	17
Berar	18
Assam	18
Lower Burma	18
V. Vaccination:	
General results	20
Bengal	20
Madras	20
Bombay	20
Punjab	21
North-Western Provinces and Oudh	21
Central Provinces	21
Berar	21
Assam	22
Lower Burma	22
VI. Medical Institutions:	
Civil Hospitals and Dispensaries:	
Bengal	23
Madras	24
Bombay	24
Punjab	25
North-Western Provinces and Oudh	25
Central Provinces	25
Berar	26
Assam	26
Lower Burma	26
Lock Hospitals:	
Bengal	27
Madras	27
Bombay	28
North-Western Provinces and Oudh	28
Central Provinces	28
Lower Burma	28
Repeal of the Contagious Diseases Act	29
Lunatic Asylums:	
Bengal	29
Madras	29
Bombay	30
Punjab	30
North-Western Provinces	30
Central Provinces	30
Assam	31
Lower Burma	31
Medical Schools:	
Bengal	31
Madras	32
Bombay	32
Punjab	32
North-Western Provinces and Oudh	33
VII. Sanitation:	
Civil:	
Bengal	34
Madras	34
Bombay	35
Punjab	35
North-Western Provinces and Oudh	36
Central Provinces	36
Berar	37
Assam	37
Lower Burma	37
Military:	
Bengal	37
Madras	37
Bombay	37
Resolution of the Government of India on the "Practical Application of Sanitary "Principles to Towns and Villages in "India"	38

i 54798. Wt. P. 422.

ABSTRACTS.

		Page
India Sanitary Report for 1886:		
European troops		45
Native troops		59
Jails		66
General population		75
History of chief diseases		78
Vaccination		86
Sanitary works		89
General remarks		94
Madras Sanitary Report for 1886:		
European troops		97
Native troops		98
Jails		98
General population		99
Vaccination		102
Sanitary works		103
General remarks		105
Bombay Sanitary Report for 1886:		
Vital statistics		108
Vaccination		112
Sanitary works		113
Personal Proceedings and General Remarks		114
Calcutta Municipal Report for 1886		121
Calcutta Health Ditto		130
Madras Municipal Ditto		149
Bombay Municipal Ditto		158
Bombay Health Ditto		161

India Office,
26th September, 1888.

Horace Walpole,
Assistant Under Secretary of State.

REPORT.

I.—EUROPEAN ARMY.

Sickness and mortality in 1886.

THE health statistics of the European Army in India during 1886 were not so satisfactory as those of the previous year. The average strength, excluding troops on active service in Burma, was 61,015, and among them the admissions to hospital were in the ratio of 1,514 per 1,000 against 1,533 in 1885, the daily sick 75 per 1,000 against 71, and the deaths 15·18 against 14·55. The total loss during the year by deaths and invaliding was 2,229 men or 36 per 1,000 of strength, a lower ratio than in any other year on record.

The following table shows the proportions in which the armies of the three Presidencies contributed to these results:—

Presidency.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total loss.
Bengal	1885	35,031	1,661	73	13·16	20	33
	1886	38,784	1,559	73	15·52	18	34
Madras	1885	10,519	1,154	66	9·13	24	33
	1886	11,181	1,380	82	16·46	24	40
Bombay	1885	11,417	1,489	68	23·82	29	53
	1886	11,050	1,490	73	12·67	28	41
INDIA	1885	56,987	1,533	71	14·55	23	37
	1886	61,015	1,514	75	15·18	21	36

Both in the Bengal and Madras armies the mortality in 1886 was greater than in the previous year, especially among the Madras troops, which was attributed to the indirect influence of the military operations in Upper Burma upon the garrisons in Lower Burma, all of which are in the Madras Command. The striking decrease in the death-rate of the Bombay Army to a half of what it was in 1885 was due almost entirely, states the Sanitary Commissioner (Sir B. Simpson), to the transfer of the Southern Afghanistan force from the Bombay to the Bengal Command from the 1st April 1886.

As in previous years malarial fevers and venereal diseases headed the causes of sickness, while enteric fever again gave rise to the greatest mortality, followed by hepatitis and dysentery. There was very little cholera among the troops, and it is satisfactory to note that in the force serving in Southern Afghanistan the death-rate from this disease fell from 42·46 in 1885 to 0·57 per 1,000 in 1886.

As regards the individual armies there was a considerable decrease in the admissions to hospital in the Bengal Army as compared with the previous year, with an increase in the death-rate of over 2 per 1,000. Of the six geographical groups into which the Bengal Army has been divided, three recorded a higher admission-rate than the average rate of the Presidency, viz., Bengal Proper 1,675, Gangetic Provinces and Oudh 1,630, and Meerut and Rohilkund 1,902. In the other groups Agra and Central India recorded 1,526, Punjab 1,442, and Hill Stations 1,219. Compared with the previous year the admission-rates of the first and second of the above groups were greater in 1886, while all the groups except one, Meerut and Rohilkund, returned a heavier mortality, especially Agra and Central India. First in order came the Gangetic Provinces and Oudh group with a death-rate of 17·09 against 15·23 in 1885 followed by Meerut and Rohilkund with 16·68 against 18·00, Punjab 16·64 against 12·67, Agra and Central India 15·91 against 10·93, Bengal Proper 15·46 against 13·09

and Hill Stations 10·27 against 9·50. In all the groups enteric fever was the chief death cause, and except in the case of the Gangetic Provinces and of Meerut and Rohilkund, the mortality from this fever was greater than in 1885.

Of individual stations in the three Presidencies with an average strength exceeding 200 and which were occupied throughout the year, the highest admission-rates were recorded at Thayetmyo (3,005 per 1,000) and at Barrackpore (2,789). Ten other stations returned admission-rates of over 2,000, while in no station was the ratio below 1,000, the lowest being 1,116 at Kirkee. Thayetmyo also recorded the highest death-rate of 56·27, Jhansi following with 44·44; at 12 other stations the death-rates ranged between 20 and 30 per 1,000, and at 22 between 10 and 20 per 1,000.

The troops in the Rajputana, Malwa, Sind, and Aden group were not so healthy as in 1885. Of an average strength of 5,489 the admissions were in the proportion of 1,637 per 1,000 against 1,503, while the death-rate remained practically the same, 14·94 against 14·97. The increased sickness was chiefly due to enteric and other fevers, dysentery, diarrhœa, rheumatism, and venereal diseases. Enteric fever was also the most fatal disease in this force, yielding 32 out of a total of 82 deaths, equivalent to 5·83 per 1,000 of strength, which is a considerable increase on 3·19, the enteric fever death-rate in 1885. Of the three principal stations in this group (Mhow, Karachi, and Aden) only at Mhow was the health of the troops less favourable than in 1885, the admission-rate having risen from 1,503 to 1,719 per 1,000, and the death-rate from 10·26 to 12·04. The increased mortality was chiefly due to enteric fever, which caused 50 per cent. of the deaths against 23 per cent. in 1885. At the other two stations the deaths were in the ratio of 20·93 and 12·97 against 21·98 and 15·67 respectively in 1885.

In the Deccan and Nagpur group the health of the troops was not so favourable as in the previous year. The average strength was 8,457, and the admissions to hospital equalled 1,279 per 1,000 against 1,169 in 1885, and the death-rate 10·52 against 9·67. Secunderabad and Poona are the largest stations in this group; the former returned an admission-rate of 1,191 per 1,000 against 1,133 in 1885, and a death-rate of 15·90 against 10·45, and the latter of 1,267 and 10·45 respectively against 1,366 and 12·23. In the case of Secunderabad 25 out of the total 43 deaths were from enteric fever, an increase of 15 on the mortality from this cause in 1885.

The health statistics of the Southern India group were very unfavourable as compared with the previous year, the admission-rate having risen from 1,157 to 1,311 per 1,000 of an average strength of 4,309 and the death-rate from 6·88 to 10·68. The greatest increase of mortality was in enteric fever, dysentery, and hepatitis. At Bangalore, the largest station in this group, with an average strength of 1,593, there were fewer admissions than in 1885, but the mortality rose from 3·45 to 7·53 per 1,000, due chiefly to enteric fever, from which there were 8 deaths against 1 in 1885.

Among the troops serving at the four stations in Burma and Pegu (average strength 1,699) there was considerably more sickness than in 1885, with a much heavier death-rate, the admission-rate having risen from 1,215 to 1,905 per 1,000, and the death-rate from 12·52 to 34·73. The increase in sickness was chiefly due to ague, dysentery, and diarrhœa, and in mortality to remittent fever and dysentery, from which the death-rates were 4·71 and 6·48 respectively against 0·48 for each in 1885. Of the four stations, Thayetmyo, with an average strength of 391, recorded the highest admission-rate (3,005 per 1,000) and the highest death-rate (56·27). At Rangoon, the largest station, the mortality was in the ratio of 39·74 per 1,000 of a strength of 755.

In the Hill stations of Madras and Bombay there was more sickness among the troops than in 1885, which was due to fevers, but the death-rate was lower, 14·68 against 18·84. Hepatitis and enteric fever were the chief death causes, the former contributing 4 of the total 10 deaths and the latter 2.

Cholera.

Cholera was much less prevalent among the European troops in 1886 than in either of the preceding three years, but the percentage of deaths to attacks was higher. There were only 41 cases under treatment, against 199 in 1885, and of the former, 30 or 73·17 per cent. were fatal, and of the latter, 122 or 61·31 per cent. All but 5 of the 41 cases occurred in the Bengal Army, giving an admission rate of 0·9 per 1,000, against a decennial average of 5·9. The disease scarcely existed in the Madras Army, there being only one case which proved fatal; and in the Bombay Army there were four cases, all of which were fatal. During the first three months of the year when the troops in Southern Afghanistan were under the Bombay Command there was one case of cholera in the force, and in the last nine months, after the transfer to the Bengal Command, the troops were exempt from the disease.

This is a great improvement on the previous year, when there were 117 cases in the force, and 71 deaths.

Small-pox was slightly more prevalent than in 1885, the cases numbering 22, with one death, against 12 cases and no death. Of the 22 cases the Bengal Army contributed 19 and the only death, and the Bombay Army two cases. Small-pox.

Intermittent fever prevailed less extensively in the European Army in 1886 than in the previous year, the admission rate having declined from 471 per 1,000 to 332. This shows a decrease of 139 per 1,000; it is explained, however, that about 65 per 1,000 of this ratio was due to the exclusion of febricula, which in former years was included in the ague ratio. The decrease was confined to Bengal and Bombay, for in the Madras Army the admission-rate was greater than in 1885. From this fever there were 6 deaths, against 2 in the previous year, all of which occurred among the Bengal troops. Remittent and continued fevers were more prevalent than in 1885; but the rise in the admission-rate from 48 to 113 per 1,000 was chiefly due to the transfer during the year of febricula from the head of ague to these fevers. Including febricula in both years, the admission-rate in the Bengal and Bombay armies was less than in the previous year, but higher in Madras; while there was an increased mortality in the Bengal and Madras armies. The total number of deaths from these fevers was 45 or 0·74 per 1,000. Fevers.

Of all diseases enteric fever continued to be the most fatal. In the army as a whole there were 1,105 cases and 310 deaths, being in the ratios of 18·1 and 5·08 per 1,000 respectively, against 11·2 and 3·41 in 1885. All three Presidencies contributed to the increase. The Bengal Army returned an admission-rate of 21·6 per 1,000 and a death-rate of 5·70, against 14·0 and 4·05 in 1885; in the Madras Army the corresponding ratios were 11·9 and 3·85, against 6·4 and 2·19; and in the Bombay Army 12·3 and 4·16, against 7·3 and 2·54. The year's statistics clearly point to the liability of young and unacclimatized soldiers to this fever. Amongst men under 25 years of age the average mortality was 7·44 per 1,000, between 25 and 29 years 3·08, and between the ages of 30 and 34, 1·02; while the deaths among men of two years' service in India and under were in the ratio of 8·63, between three and six years' service 3·31, and between the seventh and tenth years 1·12. Medical officers were again unable to trace the fever to any definite local cause, though all the evidence confirms the belief that the young soldier is the peculiar victim to the fever. The medical officer in charge of the Lucknow Station Hospital says: "In no "part of the world is sanitation so perfect as in India, and in no station could the "dry earth system be more carefully and thoroughly carried out than here; yet "year after year, with the advent of young soldiers from home, we see the same "recurrence of the disease." Another medical officer states that his cantonment was absolutely free from the disease until some young soldiers began to arrive. And the Surgeon-General for Bombay in discussing the influence of local insanitary conditions, especially at Karachi, the native town of which, he says, is full of cesspools, concludes: "There can be no question, however, from the experience of "the past few years, that the short-service system, which necessarily introduces in "India annually such large numbers of young soldiers, has much to answer for, "as regards the increase of enteric fever, essentially a disease of the young. The "introduction of a modified system of enlistment for special service in India, whereby "slightly older and more fully formed soldiers than those at present sent out could "be obtained, is, I respectfully submit, worthy of the consideration of the Government "of India."

Dysentery and diarrhœa gave rise to an increased sickness, as compared with the previous year, and the death-rates rose from 0·86 and 0·05 respectively in 1885 to 1·20 and 0·07. As usual dysentery was most prevalent in the Madras Army, which returned a death-rate of 2·77 per 1,000. All the four deaths from diarrhœa occurred among the Madras troops. Bowel complaints.

Venereal diseases continued to show a progressive increase among European troops serving in India. In the army as a whole the admissions from all forms of the disease were more numerous in 1886 than in the previous year, being in the proportion of 389 per 1,000 of strength, against 343 in 1885. This increase of 46 per 1,000 was contributed by all three armies, but it was most marked in the Bombay Army, Venereal diseases.

which recorded a ratio of 370, against 272 in 1885. In the Bengal and Madras armies the ratios were 394 per 1,000 each against 363 and 350 respectively in the previous year.

The measures recently taken with regard to the Contagious Diseases and Cantonment Acts are set forth in Returns to Addresses of the House of Commons, Nos. 158 and 180 of 1888.

Invaliding.

The loss to the whole army by invaliding during 1886 amounted to 1,303 men, or 21·10 per 1,000 of strength. This was the lowest ratio on record, and 1·71 below that of 1885. The proportions contributed by each of the Presidencies were, Bengal 18 33, Madras 23·86, and Bombay 28·27. In each, anæmia and debility, and circulatory diseases were the chief causes of invaliding. Of the total number invalided 41 per cent. were discharged as unfit for further service. As regards the influence of residence in India upon invaliding, 43·92 per cent. of the whole number were under 25 years of age, and 24·31 per cent. had been under two years in the country, and 49·85 per cent. had from two to five years' service. In the whole army, 75 per cent. of the men were of not more than five years' service in 1886, and this ratio yielded 74·16 per cent. of the total number of men invalided.

II.—NATIVE ARMY.

Sickness and mortality in 1886.

THE health statistics of the several branches of the Native Army of India and of the army as a whole for 1886 as compared with the previous year were as follows:—

		Average Strength.	Ratio per 1,000 of Average Strength.			
			Admissions.	Daily Sick.	Deaths.	Total Deaths, including Absentees.
Bengal Native Army	1885	40,753	1,076	34	10·11	14·18
	1886	40,547	1,065	34	14·45	22·29
Madras ditto	1885	27,043	675	25	9·69	13·96
	1886	22,070	756	30	14·05	21·25
Bombay ditto	1885	22,701	1,243	43	24·84	26·01
	1886	21,089	1,231	37	15·98	20·89
Central India Regiments	1885	5,112	700	19	10·17	11·54
	1886	5,250	719	18	6·67	8·22
Punjab Frontier Field Force	1885	10,576	1,152	35	12·67	14·50
	1886	10,684	979	28	9·83	13·59
Hyderabad Contingent	1885	6,969	522	17	5·88	7·57
	1886	6,370	483	16	5·34	6·06
INDIA	1885	115,486*	978	32	13·67	16·09
	1886	106,010*	973	31	13·27	19·46

* Excluding men on active service in Burma.

It will be seen from the above that the health of the army as a whole during 1886 was slightly better than in 1885. Compared with the European Army, the mortality was nearly 2 per 1,000 less. As usual, the Hyderabad Contingent and the Central India Force were the healthiest divisions of the Native Army; while the worst results were returned by the Bombay and Bengal branches.

Malarial and simple fevers gave rise to the greatest sickness, the ratio being 429 per 1,000 of average strength against 431 in 1885. Next in order came abscess and ulcer (94·5), respiratory diseases (50·7), and dysentery (43·5). Of the total 1,407 deaths, respiratory diseases contributed 390 or 3·68 per 1,000, against a corresponding death-rate of 3·74 in the previous year; from fevers, including 5 fatal cases of enteric fever, there were 214 deaths or 2·02 per 1,000, against 2·20 in 1885. From cholera the death-rate was 1·27 per 1,000 against 1·61.

Bengal Native Army.

The health of the Bengal Native Army in 1886 was not on the whole so good as in the previous year. As shown above, the admission-rate was slightly lower, but the mortality was greater by 4·34 per 1,000, the increase being attributed to the transfer of the unhealthy Southern Afghanistan to this Command. Nearly half the admissions were due to fevers. Among the diseases showing an increase of cases were cholera, bowel complaints, and respiratory diseases, and from all these there was also an increased mortality as compared with 1885. Respiratory diseases, as usual, gave rise to the greatest proportion of deaths, the ratio being 3·28 per 1,000, an increase of 0·51 on the previous year; cholera deaths rose from 12 or 0·29, to 76 or 1·87, and dysentery and diarrhœa from 38 or 0·94, to 100 or 2·47.

The following statement shows the principal statistics of the Regular troops in Bengal, arranged in geographical groups, for 1886 and the preceding year:—

		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1885	5,722	1,278	39	9·96
	1886	5,228	1,692	66	38·45
Gangetic Provinces	1885	6,390	990	32	6·42
	1886	5,980	896	28	5·35
Rohilkund and Meerut	1885	5,476	1,179	45	10·04
	1886	5,280	1,349	45	13·64
Agra and Central India	1885	4,467	1,333	39	8·28
	1886	3,480	1,386	35	6·90
Punjab	1885	15,631	902	28	9·92
	1886	18,473	779	25	8·61

In both sickness and mortality the Bengal Proper and Assam group held the first place, and the ratios were considerably in excess of the previous year, especially the death-rate, the increase being mainly due to the unhealthiness of the troops stationed in Tammu and its neighbourhood, as shown below. Meerut and Rohilkund also recorded higher admission and death-rates than in 1885; while in the remaining three groups the mortality was lower. Of the chief causes of mortality in the several groups, cholera was very fatal in the Bengal and Assam group, contributing 55 deaths or 10·52 per 1,000 of strength, against 0·35 in 1885; but 45 of the fatal cases occurred on the Eastern frontier at and near Tammu. From bowel diseases the death-rate in this group reached 13·39 per 1,000, against 1·22. In the Rohilkund and Meerut group respiratory diseases were the chief contributors to the mortality, the ratio being 3·98, or 1·78 in excess of 1885; phthisis pulmonalis was also more fatal in this group than in the previous year, the ratio having risen from 1·46 to 2·65. As regards individual stations in the Bengal Command, the most unhealthy was Tammu, which was occupied for 11 months and recorded an admission-rate of 5,287 per 1,000 of an average strength of 286, and a death-rate of 328·67, nearly a half (157·34) being from cholera. Of the stations occupied throughout the year in Bengal, Quetta, with an average strength of 628, recorded a death-rate of 109·87, of which respiratory diseases yielded nearly a half. Silchar and outposts followed with a mortality of 77·72, Delhi with 34·11, and Sipri with 33·33.

The vital statistics of the Punjab Frontier Force were much more favourable in 1886 than in the previous year. Of an average strength of 10,684 the admissions were in the ratio of 979 per 1,000 against 1,152, the daily sick-rate fell from 35 to 28, and the death-rate from 12·67 to 9·83. Under all the chief heads of disease there were fewer admissions than in 1885, except from small-pox and phthisis, which showed a trifling increase. As in other branches of the Native Army, respiratory diseases were the chief death causes, but the actual deaths were very much fewer than in 1885, the number having declined from 67 or 6·34 per 1,000, to 46 or 4·31. There were no deaths from cholera in this force.

In the Central India Irregular Force (average strength 5,250) there was a slight increase in the admissions, with a substantial decrease in mortality, the former having risen from 700 to 719 per 1,000, and the latter having declined from 10·17 to 6·67. The decrease in the death-rate occurred mainly under respiratory diseases, from which the deaths were in the proportion of 2·10 against 4·30 in 1885. There were 4 cases of cholera in the force, but none were fatal, while in the previous year there were 9 deaths, equal to 1·76 per 1,000 of strength.

The Hyderabad Contingent continued to maintain its favourable character in regard to health. The admission-rate fell from 522 per 1,000 in 1885 to 483, the daily sick-rate (16) was 1 per 1,000 less, and the death-rate declined from 5·88 to 5·34. Of the total 34 deaths, respiratory diseases contributed 18 per cent. and phthisis 9 per cent. Cholera was absent from among these troops. In the previous year there were 7 deaths from the disease.

Madras Native Army.

In the Madras Native Army the results were not so favourable as in 1885, the ratio of admissions per 1,000 of an average strength of 22,070 being 756, or 81 in excess; the daily sick-rate, 30, or 5 more, and the death-rate, 14·05, or 4·36 per 1,000 greater. Including absent deaths, the mortality rose from 13·96 in 1885 to 21·25. These unfavourable results were attributed partly to the influence of the military operations in Upper Burma, which was felt in all the divisions of the army except the Northern, but mostly amongst the troops in Lower Burma. Cholera contributed a greater mortality than any other disease, the deaths numbering 56 or 2·54 per 1,000, against 35 or 1·29 in 1885. All the cholera deaths but 5 took place among troops on the march. Of other diseases, those of the respiratory system gave rise to 14 per cent. of the total deaths, debility 16 per cent., and fevers 12 per cent.

Of individual stations in the Madras Command with an average strength exceeding 1,000 men, Secunderabad was the most unhealthy, its admission-rate being 1,028 per 1,000, and its death-rate 13·65, against a mortality of 11·03 in 1885. The next highest death-rate was recorded by Madras 7·99, followed by Kamptee 6·92, Belgaum 5·57, and Bangalore, which is the largest station, 5·21. But of all the stations the highest mortality was recorded at Quetta, which was occupied by Madras troops for two months of the year, viz., 50·75 per 1,000, more than a half being due to respiratory diseases.

Bombay Native Army.

The troops comprising the Bombay Native Army enjoyed much better health in 1886 than in the previous year, though the statistics compared unfavourably with other recent years. The admissions to hospital were in the ratio of 1,231 per 1,000, against 1,243 in 1885; the daily sick-rate fell from 43 to 37, and the death-rate from 24·84 to 15·98, or including absent deaths from 26·01 to 20·89. This great reduction of mortality occurred chiefly under cholera, from which there were only 3 deaths against 123 in 1885. Of the total 337 deaths in hospital, 150, equal to 7·11 per 1,000 of strength, were from respiratory diseases, against 169 or 7·44 in the previous year, and 68 or 3·23 from fevers, against 83 or 3·66.

Of the larger stations in the Bombay Command the most unhealthy was Quetta, which recorded an admission-rate of 2,444 per 1,000 and a death-rate of 45·73. Just one half (167) of the total deaths in the Bombay Native Army occurred among the troops at this station, and 51 per cent. of them were from respiratory diseases and 27 per cent. from fevers. In no other station did the mortality exceed 20 per 1,000, while 16 stations recorded death-rates of less than 10 per 1,000.

III.—GENERAL POPULATION.

Vital statistics.

The registration of births among the general population of India remained very imperfect, and as yet the birth-rates are only approximations to the truth. The average birth-rate for all the provinces combined was returned at 30·31 or 2½ per 1,000 less than in 1885, an average made up of provincial ratios ranging from 14·04 in Coorg to 39·47 in the Punjab. The total deaths registered from all causes amounted to 5,016,857, or 25·34 per 1,000 of the registering population, against 5,182,597, or 26·12 in 1885. In the four provinces of North-Western Provinces and Oudh, Berar, Mysore, and Coorg, the death-rates in 1886 were higher than in the previous year. Of the death causes, fevers as usual were the chief, contributing over 67 per cent. of the total deaths. Small-pox was considerably less prevalent than in the previous year, as was also cholera, the deaths from the latter having fallen from 385,928 in 1885 to 209,150 in 1886.

The deaths from the chief diseases and from all causes in the several provinces of India, were as follows:—

	Cholera.		Small-pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1886.	1885.
Bengal, excluding Calcutta	118,368	1·78	4,049	0·06	1,057,296	15·97	55,693	0·84	1,455,305	21·99	22·74
Calcutta	1,741	4·01	15	0·03	3,442	7·94	1,258	2·90	11,447	26·42	29·30
Madras	12,417	0·44	17,129	0·61	221,679	7·89	27,379	0·97	533,927	19·72	21·86
Bombay	167	0·01	876	0·05	281,450	17·10	36,612	2·23	381,185	23·17	28·78
Punjab	12	—	10,770	0·57	336,263	17·85	17,826	0·95	501,266	26·60	26·91
North-Western Provinces and Oudh	34,565	0·78	10,486	0·24	1,216,618	27·58	59,065	1·34	1,467,613	33·27	31·98
Central Provinces	16,679	1·89	2,774	0·31	176,429	20·01	25,576	2·91	293,109	33·24	34·21
Berar	976	0·37	116	0·04	45,643	17·35	16,791	6·38	96,546	36·70	34·05
Assam	20,188	4·47	564	0·12	63,857	14·10	16,913	3·74	125,726	27·77	27·91
Lower Burma	4,027	1·10	115	0·03	28,444	7·79	2,512	0·69	56,783	15·54	19·39
Mysore	10	—	4,175	1·02	39,891	9·75	5,844	1·42	70,324	17·18	15·91
Coorg	—	—	43	0·24	3,184	17·85	156	0·87	3,626	20·33	16·57
Total	209,150	1·05	51,112	0·25	3,474,196	17·54	265,757	1·34	5,016,857	25·34	26·12

Bengal.

As in previous years, registration of births in the Province of Bengal, in 1886, was confined to selected areas. In 45 municipalities 34,734 children were born, the average birth-rate per 1,000 of population being 21·04 against 24·71, the ratio of 46 towns in 1885. Of these 45 towns only four returned what may be accepted as approximately correct rates, ranging from 43·72 to 33·94, the remainder varying from 30·54 to 4·46.

The province enjoyed exceptionally good health in 1886. In comparison with the previous year, and also with the quinquennium 1881–85, there was a decline in the mortality from cholera, small-pox, and bowel complaints, especially from cholera; while, on the other hand, there was an increase in fever mortality which, however, was confined to the rural circles, as the urban circles exhibited a very marked decrease. "This indicates," the Sanitary Commissioner (Dr. Lidderdale) says, "that these circles "enjoy superior health, so far as this disease is concerned, due, apparently, to the "observance in them to a greater extent of sanitary precautions." The total registered deaths were 1,455,305 or 21·99 per 1,000, against 1,504,745 or 22·74 in 1885. The district death-rates varied from 13·24 in Muzefferpore to 36·17 in Shahabad. In 17 districts an enhanced mortality was registered, the increment in the majority of them being attributed to improved registration. Still the general result, in the opinion of the Sanitary Commissioner, was vitiated by many individual defects which might, with more care and attention on the part of local officers, be rectified, though the improvement in registration of late years entitle the statistics, he says, to be considered as a basis for approximately estimating the health conditions of the people over large areas.

Cholera was less prevalent in 1886 than in any year of the preceding decade. The registered deaths fell from 173,767 or 2·62 per 1,000 in 1885 to 118,368 or 1·78. Only 9·33 per cent. of the villages were attacked against 12·61 in the previous year. In nine districts the mortality was exceptionally high, while 26 returned lower death-rates than in 1885, the diminution ranging from 0·50 to 6·13 per 1,000; in the remaining 19 districts the mortality was in excess of the previous year, the increase ranging between 0·01 to 2·38 per 1,000. There was very little cholera at the fairs held during the year, which was due to a great extent to precautionary sanitary measures. The Sanitary Commissioner, in his report, discusses the influence of meteorological conditions on cholera prevalence, but he inclines to the opinion that this method of inquiry is not likely to throw much light on the etiology of the disease. "We already "know," he says, "the conditions which foster the disease, and what the Sanitary "Department requires is more power and more money to remove them." The details which he gives regarding the outbreak and prevalence of cholera in different districts point to the existence of all or almost all the insanitary conditions, namely, dirt, foul air, impure water, ill-constructed or ill-ventilated homesteads, and unwholesome or insufficient diet.

From small-pox there were 4,049 deaths, equivalent to 0·06 per 1,000 of population, which is less than half the mortality of the previous year, and the smallest on record. This great immunity was attributed to the large extension of vaccination during recent years. More than half the deaths (55 per cent.) occurred in the seven districts of the Patna division, to only two of which has vaccination yet been extended, while one alone (Chumparun), contributed 31 per cent. of the total deaths. The largest proportion of the mortality, as usual, occurred among infants and children, no less than 74 per cent. of the deaths having been borne by them.

Fevers were slightly more fatal than in 1885, the number of deaths having risen from 1,042,142 or 15·75 per 1,000 to 1,057,296 or 15·97. It is noteworthy that during the previous decade the urban population suffered considerably more from fever than the rural, whereas in the year under report the reverse was the case, the mortality in urban circles being 12·29 and in rural circles 16·11 per 1,000. But although the mortality was higher than in any previous year, the opinion largely shared locally was that improving registration had no small share in the increase. In 10 districts the mortality exceeded 20 per 1,000, the worst cases being Julpigoree (31·01), Shahabad (29·20), Pubna (27·68), and Rungpur (27·12). Among the causes given for the increased mortality were imperfect drainage, general uncleanliness, insufficient clothing, poor food, and damp and improperly constructed dwellings.

Bowel complaints were not so fatal as in 1885, the number of deaths being 55,693 or 0·84 per 1,000, against 63,808 or 0·96. It is reported that hill diarrhœa now occurs in Darjeeling with seasonal regularity during the early months of the rainy season, when not a household escapes it, although in former years it was one of the advantages claimed for Darjeeling as a sanitarium, that it was free from this plague of other hill stations. Although rarely fatal, it causes much suffering and discomfort, and, if neglected, seriously undermines the constitution. The cause was not known, but the Sanitary Commissioner ascribed it to the probable increase of population and overcrowding, and complete clearance of the forest.

The year 1886 was one of low general mortality in Calcutta. The total number of registered deaths was 11,447 or 26·4 per 1,000, against 12,707 or 29·3 in 1885. Of these 1,744 were due to cholera, an increase of 141 on the previous year. An investigation was carried on during the year by the Health Officer (Dr. Simpson) into the causes which facilitate the spread of cholera, and he submitted a special note on the subject. (*See* page 138.) The attention of the Municipal Commissioners was called to the suggestions made by him for improving the sanitary condition of the localities mostly affected by the disease. From small-pox there were only 15 deaths in the city, being the smallest number yet recorded, and from fevers and bowel complaints there were 3,442 and 1,258 deaths respectively, against 3,831 and 1,655 in 1885.

Registration of births in Madras Presidency during 1886 was attended with Madra
better results than in the previous year. The number registered was 855,034 or 30·4 per 1,000, against 824,042 or 29·3 in 1885. The average rate was made up of district-rates ranging from 17·8 in Nilgiris to 42 per 1,000 in Chingleput. Eight of the 22 districts in the Presidency recorded lower rates than in the preceding year, but in all districts the birth-rates exceeded the average of the previous 10 years. The registered deaths numbered 553,927 or 19·7 per 1,000, against 615,449 or 21·8 in

1885, the decrease being mainly due to the decline of cholera and small-pox. As usual, the mortality amongst infants was very high compared with the rates at other periods of life. Among children under five years of age the deaths were in the proportion of 38·8 per cent. of the total number. In 16 districts the mortality ranged from 15·4 to 19·9 per 1,000, while in five showing the highest ratios, except Madras City (36·1), the range was from 22·7 to 25·6. These results as a whole show that registration, though improving, is still far from being perfect.

There was a marked decrease in cholera deaths, the number having declined from 58,109 or 2·06 per 1,000 in 1885 to 12,417 or 0·4. Over half the deaths (7,053) took place in the Godavari district; next in order came Kistna with 2,919 deaths, and Malabar with 1,039. The first and second of these districts were also conspicuous in 1885 for their high mortality from cholera. In eight districts there was not a single cholera death, and in five others the numbers were below 10. Tanjore, where cholera is supposed to be endemic, returned only 30 deaths.

The year's statistics also show a considerable decrease in the deaths from small-pox, the fatal cases having fallen from 34,726 or 1·23 per 1,000 to 17,129 or 0·6. All the districts were affected, and excepting in Madras City, where vaccination is compulsory, and where there was only one death, and the Nilgiris, the victims were numbered by hundreds, and in some cases by thousands. The heaviest mortality occurred in North Arcot, Malabar (1·2 per 1,000 each), and Tinnevelly (1·0). Nearly 60 per cent. of the total small-pox deaths were of children under 12 years of age. The disease was most prevalent in those districts in which vaccination was carried on under many disadvantages, owing to passive opposition and caste prejudices against the operation.

On the other hand the mortality from fevers was greater in 1886 than in any of the previous six years. The deaths numbered 221,679 or 7·9 per 1,000, an increase of 2,893 on 1885. Kurnool again suffered more severely than any other district, the death-rate reaching 17·0 per 1,000, and in five other districts the mortality in each exceeded 10 per 1,000.

Bowel complaints gave rise to a smaller mortality than in 1885, namely 27,379 deaths or 0·9 per 1,000 of population, against 31,209 or 1·10. The district of Madras town continued to head the list with a ratio of 6·5, and next came Chingleput with 4·2 per 1,000.

Bombay.

The registration of births and deaths in Bombay Presidency improves year by year, but the returns are still very defective. The registered births in 1886 amounted to 581,553 or 35·34 per 1,000, against 572,431 or 34·79 in 1885. Among the districts showing an increase, the most noticeable were those of the Sind Division, where the birth-rate (29·16) was nearly 10 per 1,000 in excess of the ratio of the previous year. The average birth-rate of the Presidency was made up of extremes varying from 45·60 in Dharwar to 18·98 in Bombay City. The Sanitary Commissioner (Deputy Surgeon-General Hewlett), called special attention to the defective registration of births in the city, where the ratio has declined year by year with one unimportant exception from 26·38 in 1880.

The year was a remarkably healthy one, and the Presidency enjoyed a freedom from epidemics. Deaths were fewer than in any year since 1882, the number recorded being 381,185 or 23·17 per 1,000, a decrease of 92,406 or 5·6 on 1885. The district death-rates varied from 12·43 in Upper Sind Frontier to 29·71 in Broach. In Bombay City the death-rate was 25·62 per 1,000, against 27·89 in 1885. The mortality among children under five years of age in the Presidency was again lamentably high, viz., 44·67 per cent. of the total deaths, "an unmistakeable proof of local insanitation. "Year after year," it is stated, "the rural inhabitants have the effects of their filthy "habits clearly pointed out to them. They are, however, perfectly callous to sound "advice, and ascribe the prevalence of an epidemic to divine wrath. Something can "be, and is, done in municipal towns, especially the larger ones. Want of "funds in the smaller towns is very often a hindrance to effective sanitary measures."

One of the most noticeable features of the year was the almost entire absence of cholera. Only 167 deaths were registered from it, against 37,287 or 2·27 per 1,000 in 1885, and all occurred in less than one per cent. of the villages. Just a half (83) of the deaths were returned by seven districts in the month of January, when the intensity of the epidemic of the previous year suddenly ceased, as in the following month only two cholera deaths were registered throughout the Presidency, "The "lessened prevalence of cholera during 1886," the Sanitary Commissioner states, "was certainly not due to any diminution of filth in and around villages and towns

"in the Presidency, and the only way to account for it is by the supposition "that the factor necessary for its development (probably atmospheric) was absent."

Small-pox also was less fatal than in any of the previous four years, the number of deaths being 876 or 0·05, against 2,646 or 0·16 in 1885. According to age 26·37 per cent. of the deaths occurred among infants under one year of age, whilst 41·32 per cent. were children between the ages of 1 and 12 years.

Fevers were the cause of 281,450 deaths, equal to 17·10 per 1,000 of population, less than in 1885 by 32,787 or 2 per 1,000, and also below the average of the previous ten years, which was 282,220. Of the five divisions of the Presidency, Sind was the only one which recorded a higher fever mortality than in 1885, viz., 15·63 against 12·90.

Bowel complaints contributed 36,612 deaths to the year's mortality, or 2·23 per 1,000, against 45,056 or 2·73 in 1885. All the five divisions of the Presidency recorded fewer deaths than in the previous year.

Throughout the province of the Punjab the year 1886 was a healthy one. Births were registered to the number of 743,739 or 39·47 per 1,000 of population, exceeding the number registered in 1885 by 11,805 or 0·63. In the 49 principal towns the average birth-rate was 39 per 1,000, identically the same as that of the province as a whole. Fourteen districts recorded birth-rates of over 40 per 1,000, 12 between 30 and 40 per 1,000, and 5 below 30 per 1,000. In all the districts excepting Simla and Delhi the births exceeded the deaths, the average excess being in the ratio of 12 per 1,000 of the population. Registration of births and deaths in the frontier districts remained very defective. **Punjab.**

The number of deaths registered was 501,266 or 26·60 per 1,000, against 507,140 or 26·91 in 1885. About a half of the deaths were of children under five years of age. By districts the death-rates ranged from 11·29 in Dehra Ghazi Khan to 40·16 in Delhi. From a table given in the Officiating Sanitary Commissioner's (Surgeon-Major A. Stephen) Report, it appears that the last three months of the year, the months following the rains, and in which the greatest decrease of temperature takes place, are the most unhealthy, and the spring months, or those in which the temperature again rises are the most healthy.

The province was singularly free from cholera during the year, only 12 deaths being registered, against 1,936 in 1885, and of these only three were pronounced on closer investigation to be undoubted cases of cholera. "No better proof," the Government of India remark, "can be given of the non-contagiousness of this disease (as "popularly understood) than the occurrence of a few isolated cases in a large "province. These years of immunity teach that, if there be a specific *materies* "*morbi* of the disease, it must be a remarkably enduring one, capable of at "once infecting or lying dormant, to be later revitalised only under very special "conditions."

On the other hand, small-pox was more prevalent than in 1885, the deaths having increased from 7,575 or 0·40 per 1,000 to 10,770 or 0·57. The disease was unusually active in the northern parts of the province, especially in Peshawar district, which recorded 1,578 deaths or 2·66 per 1,000, and of this number 630 occurred in the city alone.

The fever mortality of the year was less than in 1885, the deaths numbering 336,263 or 17·85, against 346,763 or 18·40. The irrigated districts of Gurgaon, Delhi, Karnal, and Rohtak were again among the greatest sufferers, but efforts were being made to reduce the prevalence of fevers in these localities by a re-alignment of the Jumna Canal and by drainage operations. As regards two of the districts, statistics show that the health of the villages in Delhi and Karnal, situated on the banks of the Western Jumna Canal, have gradually improved since the new alignment of the canal and improved drainage schemes were commenced in 1883.

From bowel complaints 17,826 deaths were registered, being 115 more than the number of 1885, and equal to 0·95 per 1,000 of population. Usually the greatest mortality takes place in September and October, after the monsoon rains, but during the year under review May was the most fatal month.

The year 1886 was one of excessive rainfall and much sickness throughout the North-Western Provinces and Oudh. The birth-rate was exceptionally low, being 37·62 against 41·24 in 1885, and was attributed chiefly to the debilitating influences which prevailed during the preceding year, although there appears to be little doubt **North-Western Provinces and Oudh.**

that the decrease was partly due to imperfect registration, as shown by the variation in the district birth-rates from 24·20 in Mainpuri to 51·60 in Lalitpur. There were 1,467,613 deaths registered, or 33·27 per 1,000 of population, against 1,410,639 or 31,98 in 1885, the provincial rate being made up of district ratios ranging from 20·42 in Dehra Dun to 61·65 in Moradabad.

As regards the chief causes of mortality, cholera was far less virulent than usual, and the deaths fell from 63,457 or 1·44 per 1,000 in 1885 to 34·565 or 0·78. Of the total 49 districts in the province all but six recorded deaths from the disease, though some very few. More than a fourth of the mortality (8,995) occurred in the two contiguous districts of Bareilly and Shahjahanpur. As in previous years the western districts suffered the least, especially those in the Meerut and Agra divisions, in none of which, during the past five years, has the mean cholera death-rate exceeded 0·56 per 1,000, while in the majority it had not reached half that amount. The whole of the cholera deaths were reported from less than four per cent. of the total 105,421 villages.

Small-pox was also less fatal than in 1885, the deaths having fallen from 14,593 or 0·33 per 1,000 to 10,486 or 0·24. The only districts which suffered to any considerable extent were Gonda (3·00 per 1,000), Lalitpur (3·65), and Bahraich (1·09), these three districts returning more than half the total deaths. By age, 3,442 of the deaths occurred among children under one year of age, and 5,831 between one and 12 years. No less than 4,321 of the 4,784 small-pox deaths which occurred in Gonda and Bahraich were of children under 12 years of age. In these two Oudh districts vaccination is reported to be very backward, especially in Gonda where the vaccinators are said to be lazy and apathetic.

Fevers were exceptionally prevalent and contributed 1,216,618 deaths or 27·58 per 1,000, being 92,463 or 2·10 per 1,000 in excess of the number registered in the previous year. Out of every 100 deaths from all causes, 83 were reported as from fever. This heavy mortality was attributed to some extent to the excessive rainfall, though some districts, where the rainfall was absolutely greatest, were comparatively healthy. Fevers prevailed with severity in almost every district, but the mortality was unusually high in Moradabad (54·18), Bareilly (48·84), Tarai (47·99), Budaon (45·09), and Bulandshahr (40·59). As regards canal irrigation much has been done to improve the drainage channels, and to prevent injurious use of water, and the subject continued to receive the attention of the Local Government. "But when all has been done that "can be, conditions favourable to malaria will, it is to be feared, continue to exist in "wet years. Against this has to be set the incalculable benefits derived by the "population in those tracts where years of drought occur."

Bowel complaints gave rise to a mortality of 59,065 or 1·34 per 1,000, against 64,409 or 1·46 in 1885. The returns under this head are still reported to be untrustworthy, and "somewhat more worthless than before."

Central Provinces.

The year 1886 in the Central Provinces was not healthy, though compared with the previous year there was a slight improvement. Fewer births were registered than in any year since 1875, and numbered 333,170 or 37·79 per 1,000, against 399,971 or 45·36 in 1885. In all the districts, except Sambalpur, there was a decrease, but chiefly in those of Chhindwara, Seoni, and Betul, which suffered so severely from fever in 1885. The number of deaths registered was 293,109 or 33·24 per 1000, against 301,684 or 34·21 in the preceding year. Nine out of the 20 districts recorded an increased mortality as compared with 1885, and was most marked in Balaghat (9·57 per 1,000), and Narsinghpur (6·79), in both of which fever was the chief cause. The remaining 11 districts showed a decrease, the most notable being Chhindwara (23·8), Murwara (11·6), and Seoni (9·5), In the case of Murwara, the decrease was due chiefly to the absence of cholera, and in the other two districts to the abatement of epidemic fever.

Cholera, though very prevalent, was less so than in 1885, the number of deaths having declined from 21,868 or 2·48 per 1,000 to 16,679 or 1·89. The disease was especially severe in the districts of Raipur, where more than half (9,738) the deaths occurred, Bilaspur (3,670 deaths), and Balaghat (1,073). In Raipur district, 24 per cent. of the villages were attacked, while in the Province as a whole, 6·5 per cent. were affected. Five districts enjoyed complete immunity, and in five others there were only one or two sporadic cases. The mortality in the towns was equal only to 0·6 per 1,000; in the districts it was 2·0 per 1,000. This great difference, it is stated, was presumably due to the greater attention paid to sanitation in towns than in villages.

From small-pox 2,774 deaths were registered, equal to 0·31 per 1,000 of population, against 3,364 or 0·38 in 1885, and 0·43 the mean of the previous five years. The disease was widely spread, as deaths were recorded in 4 per cent. of the villages. All the districts were affected but three (Nimar, Burhanpur and Chhindwara). Bhandara was the chief sufferer, contributing 1,313, or nearly half of the total deaths. Over 82 per cent. of the deaths occurred among children under 12 years of age.

Fevers gave rise to 176,429 deaths or 20·01 per 1,000 of the population, a slight increase on 170,634 or 19·35, the number registered in 1885. There appears to be little doubt however from results of enquiries, that a great portion of this mortality was due to other causes, as a great many cases in which fever is only a prominent symptom were put down to it. And this state of things, it is pointed out, must continue so long as the registration of deaths is entrusted to uneducated persons. The provincial fever death-rate was made up of district ratios ranging from 7·19 per 1,000 to 38·46.

Under bowel complaints the registered deaths amounted to 25,576, or 2·91 per 1,000, against 27,455 or 3·11 in 1885. Sambalpur district was again conspicuous for its high death-rate (11·45). In their memorandum on the Central Provinces Sanitary Report for 1885 the Army Sanitary Commission suggested, in connection with the continued high mortality in this district, an examination of its water supply, and this was ordered to be made, but the result is not yet known.

Registration of vital statistics in Berar during 1886 was not attended with such satisfactory results as in the previous year. The number of births registered was 98,229 or 37·3 per 1,000, being 14,552 or 5·6 per 1,000 less than that of the previous year, and the lowest ratio recorded since 1878. Though the province enjoyed unusual immunity from epidemics of cholera and small-pox, the year was not a healthy one, owing to the greater prevalence of fever of a severe type in some districts. The total number of deaths registered was 96,546 or 36·7 per 1,000, against 89,558 or 34·0 in 1885. In the several districts the death-rates varied from 33·0 in Wun to 39·6 in Ellichpur. Berar.

From cholera there were 976 deaths, equal to 0·4 per 1,000, as compared with 3,683 or 1·4 in 1885. There were two epidemical outbursts during the year. The district of Wun was the chief sufferer, contributing 813 (2·0 per 1,000) of the total cholera deaths. There were a few sporadic cases in the first two months of the year; in March the disease broke out epidemically, reaching its maximum in April, and almost died out in June. It again recurred with fresh intensity in July, attained its maximum in August, and again subsided in October. The disease prevailed also in the districts of Amraoti and Akola, but only in a mild form, the mortality being in the proportion of 0·2 and 0·1 per 1,000 respectively. Of 5,526 villages in the province, only 100 suffered, and of these 77 belonged to Wun district.

For some years small-pox had shown a steady decline, and in 1886 there were only 116 deaths, all but three having occurred among children under 12 years of age. This immunity was attributed to the progress made in vaccination, especially among infants.

The deaths registered from fever exceeded the total of all other death causes, and numbered 45,643 or 17·3 per 1,000, against 37,339 or 14·1 in 1885. As usual, the largest proportion of deaths occurred in Wun district, which recorded a fever mortality of 24·8 per 1,000, against a five years' mean of 20·8. Registration in regard to this cause of death is, the Sanitary Commissioner (Dr. Little) states, not so reliable as in the case of cholera and small-pox, as many diseases of which fever is only a symptom are entered under fevers, though, as the hospital and dispensary statistics prove, they are the chief causes of sickness and death.

A total of 16,791 deaths, or 6·4 per 1,000, was returned from bowel complaints, against 15,785 or 6·0 in 1885. Of the six districts in the province, Ellichpur suffered the most, recording a death-rate of 10·3 per 1,000.

Little or no progress was made in the registration of births and deaths in Assam in 1886. In the area under registration the births fell from 126,566 or 27·95 per 1,000 in 1885 to 124,743 or 27·55, and the deaths from 126,344 or 27·91 to 125,726 or 27·77. There was thus an excess of deaths over births of 983, to which all the districts of the Brahmaputra contributed, while in the two districts of the Surma valley and in the Khasi Hills the reverse was the case. Among the coolies in the tea gardens the mortality was very high, rising from 35·50 in 1885 to 38·25 in 1886. The Sanitary Commissioner (Dr. Eteson) explains that the difference between the provincial and tea gardens Assam.

death-rates was due to the labour of the coolies being one of frequent exposure to disease causes from which the general population was exempt.

The one great feature of the sanitary history of the year was the lamentable mortality from cholera, no less than 20,188 persons having died from it, equal to 4·47 per 1,000 of population, and exceeding the number of the previous year by 12,435 or 2·76 per 1,000. Cholera was epidemically severe in the Brahmaputra valley where the death-rate reached 7·13 per 1,000; while in the Surma valley the death-rate was only 1·90 per 1,000. The district of Nowgong recorded a cholera mortality ratio of 10 per 1,000, and the town of Gauhati the unprecedented ratio of 22·74 per 1,000. The disease was also more fatal in the tea gardens than in 1885, the deaths having risen from 1,076 to 1,702. But while the disease was so fatal among the general population the immigrant coolies travelling up the Brahmaputra enjoyed a comparative immunity from it.

Only 564 deaths were registered from small-pox against 1,980 in 1885. Nine of the chief towns, with an aggregate population of 59,347, had but one fatal case among them. The disease was more severe in the Khasi and Jaintia Hills than in any other district, the deaths being in the ratio of 2·56 per 1,000. A little over 64 per cent. of the total mortality occurred among children under 12 years of age.

Fevers were less fatal than in any year since 1883, though more than a half of the year's mortality was due to them. The deaths numbered 63,857 or 14·10 per 1,000, against 72,482 or 16·01 in 1885. As usual, the districts of Goalpara, Kamrup, and Darrang contributed the largest proportion of deaths to population. In Goalpara, where the peculiar endemic fever known as *kála-azár* had been so prevalent, the fever death-rate was 34·79, double that of any other district in the Province. It is reported that "in spite of special dispensaries and the itinerating ministrations of native "doctors, no impression has been made upon the disease, and depopulation is "proceeding at an alarming rate. The Chief Commissioner regrets that he can see "no prospect of successfully combating the disease in this deadly Terai, which is "at present apparently passing through a cycle of special unhealthiness. The only "hope for the inhabitants appears to be emigration, and in Upper Assam there is "awaiting them an almost boundless extent of excellent land, and a healthy climate. "Several colonies of Garos have already, in fact, established themselves in the "Sibságar district, and the more who follow their example the better."

Fewer deaths were also registered under bowel complaints than in the previous year, namely, 16,913 or 3·74 per 1,000, against 19,396 or 4·29.

Lower Burma.

Owing to the disturbed state of the Province of Burma, vital statistics in 1886 were registered with even less accuracy than in the preceding year. The birth-rate fell from 25·51 per 1,000 to 22·57, a ratio made up of district ratios varying between 10·10 and 39·26. There was even a greater decline in the registered deaths, the number for 1886 being 56,783 or 15·54 per 1,000, against 72,672 or 19·89 in the previous year. The district ratios ranged from 9·51 in Toungoo to 23·03 in Hanthawaddy.

The province was free from any severe epidemic during the year. Cholera contributed 4,027 deaths or 1·10 per 1,000, against 7,685 or 2·10 in 1885. All the 16 districts but 2 were affected, those most seriously being Henzada, Bassein, and Thongwa, in the Irrawaddy division, which recorded ratios of 3·16, 2·95, and 1·93 respectively. In the province as a whole 6·34 per cent. of the villages were attacked, but in the Irrawaddy division the percentage was 13·8.

Small-pox was remarkably quiescent. Only 115 deaths were registered, the smallest number on record. Of these 74 per cent. were contributed by the districts in the Irrawaddy division, but chiefly by Bassein and Thayetmyo.

Fever deaths fell from 34,070 or 9·32 per 1,000 in 1885 to 28,444 or 7·79 in 1886. The decrease was common to all the four divisions of the province, but was greatest in Irrawaddy. As usual the highest average mortality (11·56) was recorded in the Arakan division.

From bowel complaints there was a decrease of 742 deaths as compared with the previous year, the total number registered being 2,512 or 0·69 per 1,000 of population. Little reliance can, however, be placed on these figures, as the Sanitary Commissioner points out that the dispensary statistics show that these complaints were prevalent during the year.

IV.—JAILS.

Among all classes of prisoners in India the admissions into hospital and average daily sick in 1886 were 927 and 32 per 1,000 of average strength respectively, against 979 and 34 in 1885, and the death-rate 33·34 per 1,000 against 36·20. Over a third of the mortality was due to bowel complaints, which, however, were slightly less fatal than in the previous year, the death-rate having fallen from 11·18 to 10·70. Cholera was much less fatal among the prison population in 1886 as compared with the previous year, the death-rate being 1·7 against 4·1 in 1885. The jails of five provinces were entirely exempt from the disease, and of the others, the Assam jails yielded the high mortality ratio of 13·78 per 1,000, the Central Provinces following with 6·87, and Burma with 4·14. Sickness and mortality in 1886.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1886 as compared with the previous year:—

Provinces.	1886.			1885.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal - - - -	1,361	44	37·01	1,526	51	58·40
Madras - - - -	714	24	18·01	642	23	19·48
Bombay - - - -	571	24	29·40	636	24	33·20
Punjab - - - -	1,083	26	28·56	1,000	25	27·14
North-Western Provinces and Oudh	707	27	22·85	778	28	21·84
Central Provinces - - -	1,164	37	65·40	982	38	75·50
Berar - - - -	494	12	11·04	552	14	19·14
Assam - - - -	1,802	62	54·56	2,308	76	61·70
Lower Burma - - -	783	41	61·51	872	38	42·78
Coorg - - - -	1,921	56	72·31	1,800	55	94·75
India - - -	927	32	33·34	979	34	36·20

The vital statistics of the prisoners of Lower Bengal for 1886 present the most satisfactory results on record. The admission and daily sick rates (1,361 and 44 per 1,000) were lower than in any year since 1878, while the death-rate (37·01) was the lowest yet reached. The improvement in mortality was partly due to the diminution in cholera deaths from 157 in 1885 to 40; but the true explanation of the comparative healthiness of the jails, Dr. Lethbridge, the Inspector-General, states, is to be found in the smaller number of cases of diseases of malarious origin. From fevers and their sequelæ, dysentery, diarrhœa, and anæmia, the deaths declined from 466 or 30·2 per 1,000 of average strength to 283 or 21·3 Among the convict class the mortality was in the ratio of 38·2 per 1,000 against 60·9 in 1885, or, exclusive of cholera deaths, 35·5 against 50·1. No less than 70 per cent. of the convicts who died were admitted into jail in bad and indifferent health. "How to deal with these cases," Dr. Lethbridge remarks, "neither I nor the 45 medical officers who have worked under me "can say. So long as Bengal remains the most unhealthy province in India we must "continue to receive from the free population prisoners with constitutions shattered "by repeated attacks of disease contracted in their homes." According to length of time passed in jail 41·2 per cent. of the total deaths occurred among convicts who had been under six months in jail, and 24·5 per cent. among those of 6 to 12 months imprisonment, while the percentages for longer terms were much lower, apparently showing that after the first few months have been passed the conditions of life in jail are not unfavourable to vitality. Bengal.

The highest death-rates were recorded in the following 19 jails, but it will be seen that in 10 of these the mortality was lower than in 1885 :—

Jails.	Death-rate per 1,000 of Average Strength.		Jails.	Death-rate per 1,000 of Average Strength.	
	1886.	1885.		1886.	1885.
Dinagepore - - -	127·5	170·3	Julpigoree - - -	65·7	202·0
Tipperah - - -	106·4	—	Rungpore - -	63·6	119·0
Bhagulpore, *District* - -	101·4	64·5	Mymensingh - - -	63·1	70·8
Darjeeling - - -	96·3	59·9	Beerbhoom - - -	62·3	61·2
Rajshahye, *District* and *Central*	92·5	169·5	Maldah - - - -	59·5	63·6
Chittagong - - -	85·4	80·3	Pooree - - - -	59·1	48·7
Purneah - - -	78·2	133·1	Khoolna - - -	51·6	66·8
Furreedpore - - -	77·9	34·9	Singbhoom - - -	51·5	90·6
Pubna - - - -	68·6	35·7	Jessore - - - -	50·9	42·0
Monghyr - - -	66·3	111·0			

The first in the above list (Dinagepore) owes its position to the malarious situation of the jail and to the year having been extremely unhealthy. Of the 19 prisoners who died in this jail only 4 were admitted in good health. The high death-rates of Tipperah and Bhagulpore were due to epidemics of cholera, 14 out of 16 deaths in the former having resulted from the disease, and 7 out of 15 in the latter. The high mortality of Darjeeling jail was also attributed to the bad state of health of the prisoners on admission. Rajshahye jail death-rate, although still high, shows a marked improvement on the previous year, which is attributed in some measure to the new drainage scheme. The improvement in the Purneah jail is also satisfactory, considering that it has the reputation of being a notoriously unhealthy one from the fact of its population coming from some of the most malaria-stricken spots in Bengal. Julpigoree and Rungpore, two of the most unhealthy jails in Bengal, recorded much lower death-rates than in the previous year, though they were nearly double the general death-rate of the Province.

Madras. The health of the jail population of the Madras Presidency during 1886 was on the whole satisfactory. The admissions to hospital among all classes of prisoners per 1,000 of average strength rose from 642 to 714; the daily sick-rate was 24 against 23, and the death-rate 18·01 against 19·48. No epidemics occurred in any of the jails, and there was only one case of cholera at Trichinopoly Central Jail, and this yielded to treatment. Of the 30 jails in the Presidency, in three there were no deaths, in 13 the mortality was under 20 per 1,000, in eight the rate was above 20 but below 40 per 1,000, and in six the death-rates exceeded 40 per 1,000. The highest rates of mortality were recorded in the district jails of Chittoor (53·08), since abolished, and the prisoners transferred to the central jail at Vellore; Ootacamund (46·38); Berhampore (41·55); the hill jail of Parvatipur (50·24); the Debtors Prison, Madras (45·35); and the Cannanore Central Jail (44·21). With the exception of the last of these the actual number of deaths was not large, and in the case of Berhampore all the prisoners who died (5), it is stated, were admitted in bad or indifferent health. In regard to the mortality at Cannanore, by far the greatest number of deaths occurred among old men, 7 out of the total of 18 being between the ages of 61 and 81.

Of the total 148 deaths in the jails, 128 occurred among convicts, equal to 17·73 per 1,000 of strength, and of these nearly 23½ per cent. were from dysentery and diarrhœa, and 20 per cent. from anæmia and general debility.

Bombay. The jail population of the Bombay Presidency enjoyed much better health in 1886 than in many previous years. Among all classes of prisoners the ratio of admissions per 1,000 of average strength fell from 636 per 1,000 to 571; the daily sick-rate remained the same (24), while the death-rate declined from 33·20 to 29·40, which was the lowest ratio on record. In seven jails out of 26 there were no deaths as compared with 5 in 1885, and in nine of the remaining jails the death-rate was well below the mean for the whole Presidency. The most unhealthy jails were, as usual, those situated in Sind, especially the Hyderabad and Nara jails, which recorded death-rates of 57·5 and 67·3. The health of the Nara Gang was, however, considerably

better than in 1885, when the death-rate reached 120 per 1,000, and was chiefly due to the transfer of old and and weakly prisoners to other jails on the advent of the cold weather. In the Hyderabad jail the mortality showed a considerable increase as compared with the previous year, the number of deaths having risen from 22 to 30, and the ratio from 39·6 to 57·5. Of the 30 deaths, 23 occurred in the first three months of the year, chiefly from lung diseases, due to extreme cold and exposure, notwithstanding that precautionary measures were taken in the way of clothing, &c. The two classes of diseases which contributed most to the mortality of the year were respiratory diseases and bowel complaints, the former yielding 30 per cent. of the total deaths and the latter 25 per cent. All the jails were exempt from cholera.

Of the total 199 deaths which occurred in the central and district jails all but three were of convicts, the ratio being 30·7 per 1,000 against 34·7 in 1885.

Punjab.

The health of the jails in the Punjab in 1886 was less favourable than in the previous year, the admissions having risen from 1,000 per 1,000 of average strength to 1,083, the daily average sick-rate from 25 to 26, and the mortality from 27·14 to 28·56. Among the convicts the deaths were in the ratio of 29·37 per 1,000 of strength against 28·07 in 1885. More than 50 per cent. of the total admissions resulted from fevers, but only 8 per cent. of the mortality was due to them. There were altogether 307 deaths, and of these the great majority were from respiratory diseases and bowel complaints, the former yielding 94 deaths, or 9 less than in 1885, and the latter 84, or 41 more. There was not a single case of cholera in any of the jails, and there has been no death from the disease for five years. Of the 34 jails in the province in 3 there was not a single death; in 11 others the mortality was low, ranging from 4·3 to 14·4 per 1,000; and it was highest in the following 7, viz., Lahore central jail 54·1, Dharmsala 44·9, Chenáwan 44·2, Delhi 43·3, Bannu 42·9, Lahore district 39·0, and Amritsar 37·1. The Lahore Central jail has been very unhealthy for some years, and its high rate of mortality in 1886, which, however, was rather less than usual, was attributed partly to the large number of old, and weakly, prisoners concentrated in it, and partly to malarious influences. The rate at Dharmsala, was about the same as in the previous year, and at Delhi and Amritsar the mortality ratios showed a marked decrease, in the former of 39·34, and in the latter of 22·4 per 1,000. Special attention was paid to the health of these two jails during the year, and it is hoped that when the Delhi jail has been supplied with a supply of good water the vital statistics will be more satisfactory. The high mortality of the Chináwan jail, where the prisoners are employed on hard extra-mural labour, was mainly due to pneumonia and dysentery, these two diseases alone contributing 62 (41 and 21 respectively) of the total 80 deaths in the jail; but of the deaths attributed to pneumonia it was found on inspection that some were due to typhus, among its victims, since the close of the year, being the Superintendent, Dr. Shand.

North-Western Provinces and Oudh.

The admission and daily sick-rates recorded in the jails of the North-Western Provinces and Oudh were lower in 1886 than in the previous year, viz., 707 and 27 per 1,000 respectively, against 778 and 28. On the other hand the death-rate (22·85) was 1 per 1,000 higher, the increase being mainly under fevers, hepatitis, respiratory diseases, and anæmia and debility. Cholera was present in three jails, but the attacks were, it is stated, very brief and ceased immediately on preventive measures being taken. The total number of deaths from cholera was 8, of which Gorakhpur and Shahjahanpur contributed 3 each, and Bareilly 2. In five jails the mortality exceeded 50 per 1,000 of strength, and in the remaining 47 it ranged from 7·08 in Gonda to 45·33 in Muzaffarnagar. The highest death-rate was recorded at Bulandshahr (69·29), next came Saharunpur (59·62), Gorakhpur (55·13), Meerut (52·86), and Aligarh (52·28). Owing to the continued unhealthiness of the Meerut jail it has been decided to close it. In all these cases except Gorakpur the mortality was greater than in 1885. Of the total 463 deaths among all classes of prisoners, 417 were of convicts, or in the ratio of 22·40 per 1,000 of strength, against 21·87 in 1885.

Central Provinces.

Sickness was somewhat more prevalent among the prisoners of the Central Provinces jails in 1886 than in the preceding year, the admissions to hospital per 1,000 of strength, having increased from 982 to 1,164. The increase, however, was partly due to change of practice whereby all prisoners found to be suffering from ailments incapacitating them from work were admitted into hospital. That the sickness was not of quite so severe a nature as in 1885 is shown by the decline of the daily average

sick-rate from 38 to 37 per 1,000, and of the death-rate from 75·50 to 65·40. There were altogether 239 deaths against 255 in 1885, and of these 231 occurred among convicts, being in the ratio of 66·8 per 1,000 of their average strength against 77·2. Bowel complaints were the chief death causes, and contributed 84 of the total deaths. Cholera was fatal in 25 cases, all of which occurred at three jails, Sambalpur contributing 11, Raipur 10, and Balaghat 4. But although there was a decrease in the aggregate number of deaths there was a considerable increase in the mortality in some jails, notably in the Nagpur Central jail where the number of deaths among convicts rose from 49 or 69·0 per 1,000 in 1885 to 74 or 101·5 in 1886. One most unfavourable feature in the mortality at this jail was that it occurred chiefly among prisoners who were admitted in good health. No satisfactory explanation was afforded of this state of things, but the Local Government were of opinion "that the "laxity of administration which characterised this jail under the late superintendent "also, to some extent, contributed to this large mortality." The highest mortality was recorded in the Sambalpur jail, viz., 131·7 per 1,000, which was considerably in excess of the previous year (28·2) and was due almost entirely to cholera and bowel complaints. Among jails showing a decrease in mortality as compared with 1885 the most striking instance was the case of Raipur jail where the death-rate declined from 153·1 to 60·0, and as 9 out of the 34 convict deaths were from cholera the mortality from ordinary diseases was not considered very high.

Berar. The health of the Berar jails during 1886 was generally satisfactory. The admission and daily sick-rates were lower than in the previous year, and the death-rate (11·04) was less by 8·10 per 1,000 of strength than in 1885. There were altogether 12 deaths during the year against 20 in 1885, and of these 8 occurred in Akola jail, 5 being due to remittent fever. There was no mortality from cholera in any of the jails. The Inspector-General reported favourably of the sanitary condition of the jails. Buldana was the only one in which there was overcrowding, and this was met by providing accommodation in tents and in the hospital. This matter was receiving attention, and it was thought probable that the jail would have to be enlarged.

Assam. Notwithstanding the greater prevalence of cholera, the health of the Assam prisoners in 1886 was better than in the previous year. The admission-rate per 1,000 of average strength fell from 2,308 to 1,802, the daily sick-rate from 76 to 62, and the mortality from 61·7 to 54·6. But for the large increase in the number of cholera deaths, from 8 in 1885 to 23 in the year under notice, the figures would be still more satisfactory, the death-rate from other causes than cholera being only 40 per 1,000, against 55·8 in 1885 and 51·3 in 1884. Taking the jails individually the death-rate varied from 21·82 in Sibsagar to 133·19 in Shillong; but in the majority of the jails the figures were so small that the addition of a single death materially added to the death-rate. Of the total 86 deaths, all but 5 occurred among convicts, or in the proportion of 55·83 per 1,000 of average strength, against 60·32 in 1885.

The three most important jails of the province are those of Gauhati, Tezpur, and Sylhet. In the first of these the convict death-rate was 80·91, more than half being due to cholera, and the remaining deaths, except one, to bowel complaints. Sylhet jail returned the high mortality of 124·38. It is stated, however, that this jail was not responsible for all the deaths that occurred within its walls, as 8 out of the 22 convict deaths were debitable to the Public Works jail at Telikhal; with this deduction the death-rate at Sylhet would be reduced to 79·3 per 1,000. The Tezpur jail recorded the comparatively small mortality of 48·52 per 1,000, which was partly attributed to the transfer to this jail of all the able-bodied prisoners from Disangmukh when that jail was closed at the commencement of the rains.

Lower Burma. The general health of the prison population of Lower Burma during 1886 was indifferent. There were fewer admissions to hospital than in the previous year, the ratio having declined from 872 per 1,000 to 783, but the daily average sick-rate (41) was 3 per 1,000 greater, and the death-rate rose from 42·78 to 61·51. The cholera mortality was not nearly so great as in 1885; on the other hand, fevers were more fatal, and there was a very marked increase under bowel complaints. Out of a total of 510 deaths, bowel complaints, chiefly dysentery, contributed 167 as compared with 86 in 1885, cholera 34 against 61, and fevers 24 against 15. Cholera epidemics broke out at Toungoo and Henzada, resulting in 8 deaths at the former, and 17 at the latter jail. Five other jails were invaded by the disease. The excessive mortality

of the year was attributed to various causes, but chiefly to civil disturbances and military operations which led to many of the jails being overcrowded with men who had suffered from privations prior to admission. Of the 14 jails the death-rate was highest at Shwegyin (140·70), Akyab (99·24) coming next, followed by Rangoon (78·13), and Tavoy (76·92). In the remaining 10 jails the mortality ranged between 16·81 and 55·47. In the case of convicts the average death-rate was 59·57 against 42·99 in 1885. The statistics of mortality among convicts again point to the conclusion that death results most frequently among prisoners recently admitted, for no less than 52 per cent. of the deaths occurred among those who had been less than six months in jail, and 25 per cent. among those who had been imprisoned between six and twelve months.

V.—VACCINATION.

General results.

The number of persons successfully vaccinated during 1886–87 at the special vaccination and dispensary establishments combined of the several provinces in India, was 4,950,893, of whom 1,913,287 were children under one year of age, and 2,419,154 were between one and six years. The approximate average proportion of protection afforded to the population was 28·74 per 1,000 against 28·50 in 1885–86, and the proportion of the successful vaccinations of infants to estimated births was 29·25 per cent., against 29·55 ; the latter ratio was made up of percentages varying from 79·9 in Berar, 58·3 in the Punjab, and 54·6 in the Bombay Presidency, to 9·1 in Lower Burma. On the whole the work done by individual vaccinators was less than in the previous year, but the quality was slightly better, the approximate percentage of success in primary cases being 94·43, against 92·93 in 1885.

Bengal.

During 1886–87 the Compulsory Vaccination Act was introduced into 10 towns of Bengal; it was also brought into operation in 19 others immediately after the close of the year, making a total of 114 towns, 4 cantonments, and 9 rural areas in which it was in force. The total number of vaccinations performed was 1,610,277, against 1,368,996 in 1885–86. Every circle contributed to the increase except Calcutta, where there was a diminution of 1,802 operations, due chiefly to paucity of unprotected children. Of the total operations 1,602,527 were primary cases, with a percentage of success of 99·25. According to age only 223,439 of the successful primary cases were infants under one year of age, or about one-tenth of the infant population available, and 1,088,403 were children between one and six years old. The Sanitary Commissioner notices that during the seven years 1880–81 to 1886–87 only 11·45 per cent. of the estimated births underwent vaccination, showing that 88 per cent. remained in an unprotected state, and liable to be attacked by small-pox. The chief reason why infants cannot be overtaken by vaccination is reported to be the strong and universal objection parents and guardians have to children of tender age being operated on for fear of evil consequences. It is explained, however, that while this birth statement refers to the whole province, vaccination is as yet only extended to six districts, and "till establishment is provided for them the protection of the "province as a whole will remain very incomplete." It is satisfactory to learn that the prejudices of the natives against vaccination are fast dying out, and that in some places it is willingly accepted, and in others eagerly sought for. Vaccination by bovine lymph was not attended with favourable results; continued attention was, however, being given to the subject.

Madras.

The results of vaccination in the Madras Presidency during 1886–87 were not so satisfactory as in the preceding year, although a larger number of vaccinators was employed (751 against 721). The total number of operations performed fell from 766,479 in 1885–86 to 710,203, of which 697,248 were primary vaccinations, with a percentage of success of 94·4 against 94·3. Of the successful primary cases 130,986 were infants, less than a seventh of the number available, and 370,871 were children between one and six years of age. This diminution of operations was attributed to various causes, among them being the decline of small-pox, and the prevalence of cholera in some districts. But the reasons given did not appear satisfactory to the Government of India. As regards the attitude of the people, the Sanitary Commissioner states that "vaccination is becoming more and more appreciated by the people, "although in some districts there is still a great deal of opposition, and vaccinators "find great difficulties in extending the benefits of the prophylactic." Vaccination was made compulsory in several towns during the year. In Madras town, where it is compulsory, there was only one death from small-pox.

Bombay.

Although the Vaccination Department of the Bombay Presidency was strengthened during 1886–87 by 10 vaccinators, the number of operations fell from 907,790 in 1885–86 to 903,910. The primary cases numbered 855,972, an increase of 1,585 on the previous year, the ratio of success being 95·49 against 95·76. The estimated number of infants available for vaccination was 932,370, and of these 559,618 were successfully vaccinated; while of children between one and six years

of age 244,364 were protected against small-pox. Vaccination from animal lymph was carried on in Bombay, Bandra, Poona, and Rajkot with satisfactory results, but elsewhere human lymph was used. The Compulsory Vaccination Act has been in force in Bombay and Karachi for nine and seven years respectively, and in both places since its introduction there has been a considerable increase in the number of infants protected. Out of every 100 persons operated on 35·75 were inspected during the year, against 34·72 in 1885–86.

Punjab.

The amount of vaccination work done in the Punjab during 1886–87 exceeded that of the previous year by 14,847 operations, the total number performed being 627,313 against 612,466 in 1885–86. Primary vaccinations numbered 602,544, with a percentage of success of 95·11 against 94·74 in the previous year. Of the primary successful cases 469,668 were infants, equivalent to 58 per cent. of the estimated births. Owing to the great difficulty experienced in keeping up arm to arm vaccination, in consequence of the unwillingness of parents to allow their children to be used as vaccinifers, vaccination by calf lymph had to be resorted to, and the experiment was attended with success in the Lahore and Gujrat districts. "There can be no question," it is stated in the Resolution of the Local Government on the Sanitary Commissioner's Report, "that the use of lymph from the calf direct will overcome one of the greatest "difficulties in the spread of vaccination, but it must be carried on with caution, and "due regard for the prejudices of the people, or it may, and probably will, have a "directly opposite effect and do great mischief." With a view to overcome the prejudices of Hindus, who consider the cow a sacred animal, vaccination by lymph from the buffalo calf was tried, and the experiment proved successful. The Sanitary Commissioner reported that inoculation was still very prevalent, and that, as it tended to the spread of small-pox, he suggested its prohibition. The Lieutenant-Governor, however, thought it undesirable to interfere in the matter except in places where vaccination was compulsory. Considerable progress was made in vaccination work in the Native States. It was estimated that 37·38 per cent. of the population were vaccinated during the year, while out of 58,000 children born 54 per cent. were protected against small-pox.

North-Western Provinces and Oudh.

Satisfactory progress was made in vaccination work in the North-Western Provinces and Oudh during 1886. In all 713,916 persons were vaccinated against 697,610 in the previous year. Of these 689,913 were primary cases, with success at the rate of 92·80 per cent. Of children under one year of age 287,819 were successfully vaccinated, equal to 41·7 per cent, of the total successful primary cases, and to 17·3 per cent. of available infants. The protection of infants varied considerably in the several circles. The best results were, as usual, obtained in the first circle (Agra and Meerut divisions), especially in the Meerut division, where, out of 126,641 children born during the year, 93,847 were successfully vaccinated. Advance continues to be made in Oudh, though it remained the most backward division owing to the prejudices of the people. "It "would be easier," the Sanitary Commissioner states, "to vaccinate or inspect a "hundred children in the first circle than 10 in the Oudh division." Bovine lymph was largely in use in the Oudh districts of Lucknow and Bara Banki. Lucknow is still reported to be one of the most backward towns in the province in respect of vaccination, and the Local Government intended to bring the matter to the notice of the municipal authorities.

Central Provinces.

In the Central Provinces vaccination work during 1886 resulted in an increase of 24,927 operations as compared with the previous year, the number having risen from 384,472 to 409,399. The increase was confined to the vaccination department, as the work done by the dispensaries showed a slight decrease. Of the total cases 385,497 were primary vaccinations, with a percentage of success of 95·10. As regards the protection of the infant population, the Sanitary Commissioner states that the great majority of the people object to their children being vaccinated till they are three or four months old. He estimates that 60 per cent. of available children under one year of age were vaccinated during the year. The attitude of the people was reported to have been "decidedly obstructive in many instances, and on the whole less favourable "to vaccination than formerly." Opposition was met with in Nagpur district, and to a less extent in Wardha, as well as among the better classes in Jubbulpore.

Berar.

The amount of vaccination work done in Berar during 1886–87 was less than in the previous year by 2,150 operations, the total number having declined from 97,654 to

95,504. This diminution was attributed to the unhealthiness of the year, and consequent fewer births. All but 1,480 of the vaccinations were primary cases. the ratio of success being 95·8 against 95·4 in 1885–86. According to age 75·6 per cent. of the successful primary cases were infants and 22·3 per cent. were children between one and six years old. Of the total number of infants living at the end of the year it is estimated that nearly 65 per cent. had been vaccinated. The attitude of the people towards vaccination continues favourable; no active opposition was experienced in any part of the province.

Assam.

Steady progress continues to be made in vaccination work in Assam. The total operations performed in 1886–87 numbered 128,833, being an increase of 6,942 on the previous year. Excluding the vaccinations in tea gardens (6,933), which are stated to have been imperfectly reported, there were 121,329 primary cases, of which 112,016, or 92·32 per cent., were successful; and of these 19·3 per cent. were infants, and 61 per cent. were children between one and six years of age. Of late years great pains have been taken to secure good lymph in order to win the people's confidence in the prophylactic. "It is impossible as yet to say," the Sanitary Commissioner says, "that any material results have affected the provincial population at large, but the "statistics of mortality from small-pox have now been unusually small for the last "three years, and there is frequent mention in the district reports that the confidence "of the people is being slowly gained, and that in many places there would be no "difficulty in extending the provisions of the Compulsory Vaccination Act to the "general population." The Act was in force in the municipalities of Gauhati, Sylhet, and Dibrugarh, but the provisions were not enforced with any vigour, consequently the amount of protection afforded was not great.

Lower Burma.

There was a slight improvement in the vaccination returns of Lower Burma as compared with the previous year, in spite of the disturbed political state of the province. The aggregate number of persons vaccinated was 65,669 against 65,342 in 1885–86. Primary cases numbered 61,407, with a ratio of success of 87·62 against 81·36. The number of infants successfully vaccinated was 13,493, representing only 9·1 per cent. of the estimated births. Of the above, 1,485 persons were vaccinated in the dispensaries, compared with 1,826 in 1885–86, and of these 74·78 were successful primary cases. Much vaccination work was done by several missionaries of various denominations, but no record was kept. It is reported that unusual difficulties were met with in carrying on vaccination, especially in some of the rural circles; this was partly attributed to the low mortality from small-pox. Endeavours were made during the year to facilitate the spread of vaccination among the people by teaching Burmans to perform the operation. The municipality of Bassein sought the protection of the Vaccination Act during the year.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1885 and 1886, and the number of patients under treatment:—

Provinces.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1885	234	25,766	960,218	985,984
	1886	234	24,820	1,006,457	1,031,277
Calcutta and Howrah	1885	7	23,863	239,764	263,627
	1886	7	24,081	240,380	264,461
Madras	1885	307	40,564	1,854,372	1,894,936
	1886	316	39,602	1,977,557	2,017,159
Bombay	1885	217	37,642	1,568,326	1,605,968
	1886	222	36,444	1,576,677	1,613,121
Punjab	1885	193	40,810	1,739,517	1,780,327
	1886	194	41,893	1,806,390	1,848,283
North-Western Provinces and Oudh	1885	244	47,127	1,889,225	1,936,352
	1886	251*	48,299	2,061,179	2,109,478
Central Provinces	1885	83	7,330	772,102	779,432
	1886	84	7,419	819,779	827,198
Berar	1885	42	2,185	224,307	226,492
	1886	42	2,345	232,250	234,595
Assam	1885	47	3,330	131,058	134,388
	1886	50	3,664	152,731	156,395
Lower Burma	1885	32	11,985	176,958	188,943
	1886	34	14,485	184,089	198,574
Coorg	1885	2	497	12,482	12,979
	1886	2	77	8,596	8,673
Total	1885	1,408	241,099	9,568,329	9,809,428
	1886	1,436	243,129	10,066,085	10,309,214

* Statistics were furnished for only 226.

Bengal.

There were 234 dispensaries open in Bengal during 1886, one (Daudnugger, in Gya district) being a new establishment. At these 1,031,277 patients were under treatment against 985,984 in 1885. The increase, however, was entirely among out-door patients, as the in-door practice in dispensaries fell off by 946 patients. Notwithstanding the large increase of 46,127 patients over the previous year, the "figures," the Local Government notice, "continue to show that these institutions are not, as a rule, resorted "to by the people as largely as might be wished; that the proportion of the population "having recourse to them is exceedingly low, and that the attendance at all but a few "hospitals bears no relation to the presence or absence of epidemic disease in the "different districts of the province. It is, however, gratifying to learn that in "Dr. Cowie's (Inspector-General) opinion these charities are gaining in popularity, "that there are apparently signs that the value of European medical science is being "appreciated, and that more satisfactory work is being on the whole done." Among the house patients the death-rate was in the proportion of 144·8 per 1,000, against 155·9 in 1885. Taking into account the class of cases usually received as in-door patients, the ratio of mortality was looked upon as far from excessive. The total number of operations performed during the year was 56,074; of these, 3,454 were of a major kind, 2,689 resulting in cure. Of the major operations 396 were connected with the eye.

The following statement shows the number of patients who sought relief at the Calcutta medical institutions, including the voluntary lock hospitals at Alipore and Sealdah, and the Howrah General Hospital during 1886 and the previous year.

Medical Institutions.	1886.				1885.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	5,880	49,985	55,865	101·7*	5,897	47,149	53,046	104·41*
General Hospital	3,696	—	3,696	38·69	3,417	—	3,417	31·02
Mayo Hospital and Dispensaries	2,697	177,817	180,514	104·5	2,564	179,208	181,772	110·37
Campbell Hospital	7,313	—	7,313	198·68	7,611	—	7,611	212·06
Municipal Police Hospital	2,396	—	2,396	12·1	2,329	—	2,329	12·02
Voluntary Lock Hospitals	484	1,629	2,113	47·52	414	1,889	2,303	43·47
Total Calcutta Hospitals	22,466	229,431	251,897	110·65*	22,232	228,246	250,478	120·23*
Howrah General Hospital	1,615	10,949	12,564	167·8	1,631	11,518	13,149	199·87
Grand Total	24,081	240,380	264,461	116·49*	23,863	239,764	263,627	125·79*

* Reckoned on cases treated, exclusive of ophthalmic cases.

From the above it will be seen that there was an increase of 218 in-door patients and of 616 out-door patients as compared with 1885. In only one of the three Calcutta hospitals which receive out-door patients, viz., the Medical College, was there an increase in attendance. Among the inmates of the Calcutta hospitals the death-rate was 110·65 per 1,000 against 120·23 in 1885; including the figures of the Howrah General Hospital, the total mortality was 116·49 against 125·79, a lower rate than in any year since 1879. There was an increase in cholera cases from 627 to 781, and of deaths from 362 to 424; on the other hand, deaths from small-pox fell from 34 to 4. The total number of cases of venereal diseases treated during the year was 13,860, against 14,080 in 1885, and of the 13,860 cases 2,113 were under treatment at the two voluntary lock hospitals. The number of important surgical operations performed was 1,561, or 56 more than in 1885, and of minor operations there were 19,040 against 18,042. An important improvement was effected during the year in the opening of a ward in the Medical College Hospital for the accommodation of European and Eurasian children. The system of nursing established at the Presidency, Eden, and Medical College Hospitals, continued to afford the highest satisfaction, and the Lieutenant-Governor again placed on record his high appreciation of the excellent work done by the ladies of the Clewer Sisterhood.

Madras.

In the Madras Presidency the number of civil hospitals and dispensaries increased from 307 in 1885 to 316 in 1886. The number of patients treated was 2,017,159 against 1,894,936, the increase being entirely under the head of out-patients, as the number of in-patients in 1886 was less by 962 than in 1885. Of the 39,602 in-patients 2,734 died, giving a death-rate of 69·0 per 1,000, or 7·3 per 1,000 less than the mortality of the previous year; 25,726 were cured, and 5,582 relieved. The chief diseases for which patients were treated were fevers, ophthalmia, and skin diseases. There was a large diminution in the number of cholera cases treated during the year, viz., from 12,144 in 1885 to 1,505. Surgical operations continued to increase, the numbers performed were 4,440 major and 57,297 minor, against 4,365 and 55,493 respectively in 1885. Of the 4,440 persons on whom major operations were performed 3,511 were cured and 179 died. The fatal major cases were therefore in the ratio of 4·0 per cent. of operations.

Bombay.

During the year under notice six new dispensaries and one hospital (the Kámá) were opened, and two dispensaries were closed in Bombay, making up the total number of these institutions open in 1886 to 222, or 5 more than than the total of 1885. The numbers of in-door and out-door patients who sought relief at the various institutions were respectively 36,444 and 1,576,677, as compared with 37,642 and 1,568,326 in 1885. The principal diseases treated were malarious fevers, ophthalmia, and skin diseases. The year was almost free from cholera, and there were only 69 cases of small-pox under treatment. Of the in-patients 26,062 were cured, and 2,496 died, the ratio per 1,000 of deaths being 68, against 74 in 1885. The number of surgical operations performed during the year was 90,197, of which 4,707 were of a major kind. Complete cures were effected in 4,122 of the major cases and 186 died. In his remarks on the various dispensaries, the Surgeon-General testifies to their popularity among the poorer classes. "And the growing system of medical relief is, I believe," he states, "regarded by the "people as evidence of the interest taken by Government in their well-being. One

" thing is certain, viz., that the more skilful and experienced the dispensary medical " officer is, the more his services are appreciated." The institutions were reported to be more or less in a fairly satisfactory condition. The sanitation of the Poonah dispensary the Surgeon-General considered very bad and required improving. He also noticed that the building at Nasik was in a very insecure state, and that a European general hospital at Aden was much wanted.

Punjab.

During 1886 one dispensary was closed in the Sialkot district of the Punjab, because it was not doing good work, and two new ones were opened, one in the Peshawar district, and the Female Hospital at Lahore, which will in future be known as the Lady Aitchison Hospital. Thus at the close of the year there were 194 institutions open, or one more than in 1885. The total number of patients treated during the year was 1,848,283, of whom 41,893 were in-door patients, or 1,083 more than in 1885, and 1,806,390 were out-door patients, a greater number by 66,873 than in the previous year. The total increase was therefore 67,956, but this is exclusive of 2,928 out-door patients who were seen at the Narowal dispensary prior to its disestablishment, and 9,505 persons in the Rohtak district, who received medical aid by itinerant dispensaries. As the year on the whole was exceptionally healthy, the increase in attendance at the dispensaries was attributed to the growing popularity of the institutions with the people. The diseases for which the largest number of patients were treated were malarial fever, though there has been a steady falling off of patients treated for this complaint, ophthalmia, respiratory affections, ulcers, and skin diseases. There were 398 cases of small-pox against 231 in 1885, but only 9 cases of cholera were treated against 1,156 in the previous year. Among in-door patients 29,253 were cured, and 1,966 died, the deaths being less by 34 than in 1885, and the death-rate 46·9 per 1,000 of average strength against 49·0. The number of surgical operations continued to increase. Of major operations 13,311 were performed against 10,502 in 1885, and of minor operations 132,863 against 119,439. The advantages of itinerating dispensaries and of requiring hospital assistants to itinerate, were gradually becoming recognised. Besides the two itinerant dispensaries in the Rohtak district, which worked satisfactorily during the year, the scheme was tried and further developed in the Delhi district with much benefit to the people. Amritsar was about to try the experiment, and in several other districts similar schemes were under consideration. The experiment of allowing vaccinators to distribute simple medicines in the course of their village visitations was also attended with success.

North-Western Provinces and Oudh.

In the North-Western Provinces and Oudh 251 charitable hospitals and dispensaries were open during 1886, seven of which were new institutions. Statistics were furnished for 226 only of the 251 dispensaries, and at these the number of persons who received relief was 2,109,478 against 1,936,352 in 1885. The year was not exceptionally unhealthy, and in the absence of any special epidemic or distress among the population, the Inspector-General (Dr. W. Walker) was disposed to attribute the increase mainly to growing confidence and appreciation on the part of the public. In-door patients numbered 48,299 against 47,127 in the previous year, and of these 36,836 were cured or relieved, and 2,808 died, against 2,763 in 1885, the ratio per 1,000 (58) being the same in both years. Adding 71,960 persons treated at the 11 mission dispensaries, and 68,740 at the 13 excluded private dispensaries, increases the above total of patients under treatment to over 2¼ millions. The confidence in European surgery is shown by the increased number of cases. The total number of operations performed during the year at the 226 institutions, was 113,567, of which 15,237 were classed as major, or important, and of these latter 11,118 were cured or relieved, and 259 or 1·6 per cent. terminated fatally. It is stated that since the close of the year under notice, proposals for the establishment of a number of new hospitals have been before the Government, that in several districts the jubilee of Her Majesty's accession to the throne has been fitly commemorated by the building and endowment of a hospital, and that the Lieutenant Governor and Chief Commissioner has had frequent occasion to acknowledge the liberality and public spirit which prompt the leading native gentlemen of these provinces to make medical and surgical relief more and more accessible to the poorer classes.

Central Provinces.

In 1886 there were (excluding 17 institutions maintained by feudatory chiefs and zamidars), 84 dispensaries open in the Central Provinces, or one more than in the previous year. At these 819,779 out-door and 7,419 in-door patients sought relief, against 772,102 and 7,330 respectively in 1885. Of the in-door patients, 5,157 were

cured, and 656 or 88·4 per 1,000 died, a decrease of 35·2 on the death-rate of 1885. "This," it is stated in the Resolution of the Government on the Inspector-General's Report, "is a satisfactory result, and one which goes to show that the comparatively "high death-rate reached in 1885, was due to exceptional causes. The fact that in "the absence of poor houses the dispensaries are required to receive moribund paupers, "picked up on the roads, must of itself cause the mortality to vary directly with the "general character of the year and the condition of the people." Among out-door patients there was an increase of 47,677, the increase being again largest in the Nagpur district, at the dispensaries of which more than one-third of the population received medical relief. Of the diseases under treatment, cases of cholera, small-pox, and bowel complaints, were fewer than in 1885, especially the former, which fell from 2,608 to 866; on the other hand there was a large increase in the number of cases of ophthalmia, malarious fevers, and ulcers. In surgical operations there was a satisfactory increase. Including those remaining from the previous year, the major operations numbered 903, of which 761 were successful and 23 fatal. As in the previous year, the largest part of the increase was in operations for cataract, which rose from 57 to 119.

Berar. The same 42 civil hospitals and dispensaries were open in Berar during 1886 as in the previous year, but the number of patients rose from 226,652 to 234,595, an increase of 7,943, which was attributed to the unhealthiness of the year. The patients belonged mostly to the class who seek out-door relief. Of in-door patients, 2,345 were under treatment, or 160 more than in 1885, and of these 87 per cent. were cured, while the average death-rate was 39 per 1,000, or 2 per 1,000 more than in the previous year. Malarious fever and skin diseases were the commonest complaints under treatment, the former contributing 20 per cent. of the total cases, but there was an unusual immunity from cholera, the number of cases having declined from 1,320 in 1885 to 66, and very little small-pox. Including cases which were under treatment at the commencement of the year, 284 major operations were performed, a decrease of 36 on the number of 1885. Of these 244 were successful, and 5 ended fatally. Many of the operations were, however, of an unimportant character, whilst fractures and dislocations comprised more than 50 per cent. of the total. The Commissioner of the Hyderabad Assigned Districts states that he visited a large number of the dispensaries in all the districts of the province, and he generally found them to be carefully and successfully managed; buildings were in some cases defective, but gradually they were being replaced by more suitable erections.

Assam. The number of dispensaries open in Assam during 1886 was 50, an increase of three on the previous year. Both in-door and out-door patients were more numerous than in the previous year, the former having risen from 3,330 to 3,664, and the latter from 131,058 to 152,371. Of the in-door patients 2,266 were foreigners, while only 1,398 belonged to the indigenous population; still this is a satisfactory increase on 1,100, the number of Assamese patients who sought in-door relief in 1885. As a rule the indigenous population prefer out-door relief, and in this direction statistics show that the dispensaries do good work. Out of the total 3,664 in-patients 2,087 were discharged cured, and 792 died, equal to 216·6 per 1,000 of treated, against a death-rate of 203·0 in the previous year. "The continued persistent high rate of mortality," the Sanitary Commissioner states, "is most depressing, and fully accounts for the "reluctance with which the better classes resort to these institutions for hospital "treatment." Malarious fevers accounted for one-fifth of all the cases of disease under treatment; as in the vital returns of the province small-pox showed a decrease, while cholera patients numbered 1,668, against 922 in 1885. Each year witnesses to an improvement in surgery. It was noticed that the Silchar dispensary greatly distinguished itself in this respect. During the year 333 major operations were performed, against 254 in 1885. Of these 272 were cured, and 18 died. The number of minor operations increased from 3,739 to 3,969.

Lower Burma. Two new dispensaries were added in 1886 to the 32 open in Lower Burma in the previous year. The patients under treatment showed an increase of 9,631, the number having risen from 188,943 in 1885 to 198,574, of whom about a half were Burmans. As regards the diseases treated, there was a falling-off in the number of cases of small-pox and cholera corresponding with the decrease in the mortality from those diseases in the province during the year, and a considerale increase in the number of cases of fever and bowel complaints. In-door patients numbered 14,485, or 2,500

more than in the previous year, and of these 10,364 were cured, 883 were relieved, and 1,053 died, the death-rate per 1,000 of total treated being 70 against 90 in the previous year. In surgical operations there was a slight decrease in the less important kind, but major operations rose from 257 in 1885 to 291 in 1886. A satisfactory feature in the year's work was the increase in the number of obstetric cases treated, which rose from 158 in 1885 to 184. This was partly attributed to the attention which has been directed to the question of providing medical aid to native women by the founding of the Countess of Dufferin's fund. The branch committee of the fund, which was founded in Rangoon in 1885, collected during the year under report a considerable amount of subscriptions, and made arrangements for establishing a lying-in hospital in Rangoon.

Lock Hospitals.

Bengal. The reports on the working of the four cantonment lock hospitals in Bengal during 1886 show a considerable improvement at Dinapore and a slight decline in admissions at Dum Dum, while at Barrackpore and Darjeeling the proportion of admissions on account of venereal diseases was very high compared with the previous year. At Dinapore, with an average strength of troops of 847, there were 145 admissions to hospital, equal to a ratio of 159·37 per 1,000, against 210·80 in 1885. The decrease in 1886 was attributed to the system of segregation of women which has been introduced. Only in 36 cases was disease contracted from the registered women of the cantonment. The results at Barrackpore contrast very unfavourably with those of the previous year, the ratio of admissions per 1,000 of the average strength of 228 being 657·89, against 194·17 in 1885. This cantonment has, however, special difficulties to contend with owing to its being a vicinity of the metropolis and other towns. Out of a total of 150 cases of disease, only 29 were contracted from the registered women of the cantonment. The average strength of troops stationed at Dum Dum during 1886 was 871, and the number of admissions from venereal diseases among them was 222 or 254·82 per 1,000, against 345·94 in 1885. Nearly the whole of the disease was reported to have been contracted during the camp of exercise, and subsequently at Calcutta; only 28 cases originated in the cantonment. At Darjeeling the number of venereal cases was 60 or 269·05 per 1,000 of average strength of 223, against 186·91 in 1885, the increase being attributed to the paucity of prostitutes. There were five women on the register at the beginning of the year, four were added during the year, and eight were removed, leaving only one at the end of the year. The number of women admitted to hospital for treatment during 1886 as compared with the previous year was fewer at all the stations except Darjeeling, where there was a slight increase.

Madras. The Contagious Diseases Act is reported to have worked satisfactorily in Madras city during 1886–87. Among the registered women 18,274 inspections were made with the result of 681 cases of disease.

Eight military lock hospitals were in operation in the Madras Presidency during 1886, or one more than in the previous year, the lock hospital at Belgaum having been ruled to be a military institution, and its statistics embodied for the first time in the general returns. Of an average strength of 7,575 troops at the eight stations in which lock hospitals were maintained, the admissions in 1886 from venereal diseases numbered 1,917 or 253·07 per 1,000, against 271·83 in the previous year. The greater ratio of 1885 is accounted for by the closing in that year of the Bellary and Cannanore hospitals. The results of the experimental closure of these two institutions proved very unsatisfactory, and after the experience gained, "it must be conceded," the Officiating Surgeon-General states, "they exercise some beneficial check upon "the transmission of venereal disease, and in repressing to some extent their "severity. More than this cannot be expected so long as the Contagious Diseases "Act is so inefficiently carried out." The Commander-in-Chief of the Madras Army fully concurred in these remarks, "and considers the experience gained by the "closure of 15 lock hospitals in India in 1885, resulting in an increase of over "40 per cent. of venereal cases amongst the troops at those stations, has fully proved "the advantages of these hospitals, and that if the Contagious Diseases Act was better "administered, much greater benefit might be expected from it."

The average number of women on the registers of these hospitals in 1886 was 700, among whom there were 2,071 cases of disease. It thus appears that each woman was detained for treatment three times during the year.

Bombay.

The results of the working of the Contagious Diseases Act in Bombay during 1886–87 show that out of 12,128 medical examinations among registered prostitutes 4 per cent. were found diseased. Among sailors ashore of the Royal Navy and Indian Marine 7 per 1,000 were under treatment for venereal diseases. It is reported that the virulence of syphilis has much abated since the re-introduction of the Act in 1880.

Lock hospitals were maintained at 11 military stations in the Bombay Presidency during 1886, and at these the average admissions for primary syphilis and gonorrhœa were in the ratio of 259 per 1,000 of average strength, against 202 in 1885. The lock hospitals at Neemuch, Mhow, and Ahmedabad, which were closed experimentally in 1885, were re-opened early in 1887, the closure having produced very unsatisfactory results. "Already," the Surgeon-General writes (July 1887), "the influence of these "institutions is observable in the diminished admissions to station hospitals for "venereal diseases." A lock hospital was opened for the first time at Hyderabad on the 27th January 1887, and has, it is reported, effected much good; sanction has also been accorded for the establishment of another at Satara.

North-Western Provinces and Oudh.

Four out of the 18 lock hospitals in the North-Western Provinces and Oudh, viz., Allahabad, Cawnpore, Meerut, and Chakrata, remained closed during 1886, but they have since been re-opened. At those which were open the ratio of admissions of soldiers per 1,000 of strength fell from 346 in 1885 to 295; still the ratio of 1886 was higher than the mean of the preceding five years, and also than the ratio in the five years before the opening of lock hospitals. The type of disease was less virulent than it had been in 1885, and the troops suffered less from it than the registered women, a larger number of whom were admitted to hospital than in the preceding year. Complaints were made by officers in charge of lock hospitals of the ill effects of unlicensed prostitution, but no sufficient case was made out either for curtailing the liberty of the men, or for extending the operations of the police to the large towns in the neighbourhood of cantonments. In some instances the statistics of individual stations showed extreme prevalence of disease, notably at Moradabad where the admissions among the soldiers were equivalent to 757 per 1,000; but this high ratio was due, it is stated, to the treatment in the station hospital of sick men belonging to regiments which passed through. There was a marked improvement at Agra, which was attributed to the greater activity of the police, and "serves to "support the conjecture that the existing regulations are not always administered "with due firmness and care."

Central Provinces.

In all the four stations in the Central Provinces where there are lock hospitals there was an increase of admissions to hospital among European troops during 1886 as compared with the previous year. At Jubbulpore the ratio was excessive, reaching 481 per 1,000 of strength, against 432·79 in 1885. It is reported that registered women were responsible for comparatively few of the admissions, the majority of the cases being contracted in promiscuous intercourse with unregistered women. The next highest ratio was recorded at Pachmarhi, viz., 368·42 per 1,000, against 149·12 in the previous year. Illicit prostitution appears also to have been the cause of the great increase of disease at this station. At Kamptee the proportion of admissions from venereal diseases was 347·26 per 1,000, against 264·46 in 1885, and at Saugor the ratio was 186·97, against 126·63. The reports all point to the same conclusion: that the spread of disease was mainly attributable to clandestine prostitution, and to the want of activity on the part of the police. The Cantonment Magistrate at Jubbulpore, says: "When the inactivity on the part of the police in arresting women "engaged in illicit prostitution is taken into consideration as required by Regulations, "it will be seen how very unreasonable the disparaging remarks are which are "so frequently made as to the efficiency of the lock hospital system to check the "spread of venereal disease."

Lower Burma.

The results attained at the three military stations in Lower Burma in which the provisions of the Contagious Diseases Act was in force in 1886, viz,, Rangoon, Thayetmyo, and Toungoo were on the whole unsatisfactory. The average strength of the garrisons was 1,349, and the number of admissions from venereal diseases, excluding 111 imported cases and relapses was 353 or 261·73 per 1,000, against 198·8 in 1885. This large increase was entirely due to the greater prevalence of venereal disease in Rangoon, which the Medical Officer attributed to the frequent changes in the troops composing the garrison of that town during the year. In the other two

stations there was a slight decrease. The imported cases rose from 22 in 1885 to 111, the increase being mainly attributed to the larger employment during the year of the European troops at Toungoo and Thayetmyo on outpost duty in the interior. The average number of women on the register during 1886 was 436, against 508 in 1885, and the number found diseased at the inspections was 735 or 169 per cent., against 891 or 175 per cent. Not only was there less disease amongst the women in 1886 than in the previous year, but there seems to have been a considerable diminution amongst them of the more serious disorders. At the dispensaries located in the five stations of Rangoon, Toungoo, Thayetmyo, Bassein, and Akyab, the admissions for venereal diseases continued to increase. In 1886 they numbered 2,836, or 178 more than in 1885. "There can be little question, I think," the Sanitary Commissioner states, "that though the increasing popularity of our dispensaries may "to some extent account for the yearly increase in the number of applicants for "advice, venereal complaints are becoming more general amongst the civil "population."

Repeal of the Contagious Diseases Act.

The whole system of compulsory preventive legislation has now been abolished in India in deference to the opinion expressed in a Resolution of the House of Commons. (*See* Returns to Addresses of the House of Commons, Nos. 158 and 180 of 1888.)

Lunatic Asylums.

Bengal.

The inmates of the lunatic asylums of Bengal during 1886 numbered 1,173, against 1,151 in 1851. Of these 87 were discharged cured, 41 were transferred to the care of friends, 4 were discharged, and 85 died, leaving 956 persons in the asylums at the end of the year. The insane population included 480 criminals, the highest number on record, of whom 60 were discharged or transferred, and 23 died. Of the total number of patients confined for mental diseases, 98 were classed as suffering from acute mania or dementia. The excess use of ganja accounted for 256 cases of insanity, and 53 were attributed to intoxicants. The health of the asylums was fairly good, though the admissions into hospital from all causes rose from 351 in 1885 to 415 in 1886. Of the principal diseases treated, dysentery was most prevalent and increased in all the asylums, especially in Dacca and Patna. Next in order came phthisis, fever, pneumonia, and cholera, but the latter was reported only from Berhampore. The death-rate per 1,000 of daily average strength rose from 77·6 in 1885 to 88·1; all the asylums contributing to the increase. The principal causes of death were dysentery, phthisis, exhaustion from mania, apoplexy and diarrhœa. "On the whole," the Inspector-General says, "considering the year, the increase of "population under confinement, the advanced age and chronic condition of many of "the lunatics, and the fact that the asylums are lunatic asylums, I think we may "pronounce the health of the institutions during the year under report to have been "fairly good."

Exclusive of the above, 47 lunatics were in confinement in the European asylum at Bhowanipore, of whom 18 were admitted during the year. Of the total number, 4 were discharged as cured, 4 were dispatched to Europe under the Merchant Shipping Act, 6 were transferred to the care of friends, and 2 died. At the close of the year 29 patients were still under treatment.

Madras.

The number of patients under treatment at the three lunatic asylums in the Madras Presidency during 1886 was 768, of whom 168 were fresh admissions. As the previous report embraced a period of only nine months in consequence of the change from the official to the calendar year, the two periods are again unsusceptible of any rigid comparison. As usual, the majority of the new patients were between the ages of 23 and 40 years, 125 out of the 168 being between these years. During the year, 118 patients were cured, 33 died, and 7 were transferred to England. The cause of insanity was known only in 235 cases out of 768, and of these narcotic drugs, hereditary taint, and epilepsy were the chief causes of lunacy, while acute mania, and chronic mania were among the most prevailing types of insanity. The health of the patients does not appear to have been good. The admissions into hospital were not so numerous as in the previous nine months, but the mortality was greater, 33 deaths, equal to 56·0 per 1,000 of daily average strength having occurred, against 27 or 46·4. The most prevalent diseases were diarrhœa, dysentery, meningitis, epilepsy, phthisis pulmonalis, and pneumonia, and except dysentery and epilepsy, these were the chief death causes. Criminal lunatics numbered 124, of whom 12 were discharged and 4 died.

Bombay.

During 1886 a new asylum was opened at Ratnagiri, and additions were made to the asylums at Poona and Dharwar, thereby rendering the accommodation for lunatics in the Bombay Presidency sufficient to meet all probable requirements for some time to come. The total population of the six asylums during the year was 887, against 899 in 1885. Of this number 257 were fresh admissions. Before the close of the year 164 were discharged, 60 as cured, 100 made over to friends, and 4 otherwise discharged. Of the 887 cases under treatment, the cause of insanity was known only in 405. Physical causes numbered 336, and moral causes 69; of the former, the use of ganja was credited with 141 cases, spirits 35, and opium 11, and of the latter grief was the alleged cause in 50 cases. The general health of the patients was good, and there was no epidemic disease, but the deaths were slightly more numerous, being 52, or 4 more than in the previous year. Of criminal lunatics there were 114 in confinement, the same number as in the previous year, and of these 11 were discharged during the year and 5 died. The Surgeon-General reports that he carefully inspected all the asylums, when he found their general condition and conservancy to be good. Gardening continues to be practised at the asylums, and though not very remunerative, it affords a healthful out-door employment for the patients.

North-Western Provinces and Oudh.

There were 1,309 lunatics under treatment in the four asylums (Agra, Benares, Lucknow, Bareilly) of the North-Western Provinces and Oudh during 1886, as compared with 1,339 in 1885. At the close of the year the number was reduced to 941 by the discharge of 260 patients and the death of 108, the latter being in the proportion of 112 per 1,000 on the average daily strength of 964. The high rate of mortality was attributed to the extreme destitution and weakness of the majority of the patients at the time of their admission. A careful diagnosis of the cases of insanity showed that out of 380 cases in which stimulants had been the predisposing cause, no less than 309 were due to the excessive use of the Indian hemp, or its preparations, while only 39 were due to spirit drinking, and 19 to opium. The accommodation was sufficient in three out of the four asylums, Benares being again so full that for a great part of the year it was impossible to admit new cases.

Punjab.

At the two lunatic asylums of Lahore and Delhi, 505 patients were under confinement in 1886, being an increase of 10 as compared with the previous year. Of this number, 58 were discharged cured, and 26 improved. The cause of insanity was, as usual, unknown in the majority of cases. The health of the asylums was not good, owing principally to the prevalence of malarial fever. The admissions into hospital were considerably in excess of 1885; the number of deaths, however, at Lahore, 21, was less by 10, while at Delhi there were 11 deaths, the same number as in the previous year. One-third of the inmates admitted into the latter asylum during the year were reported to have been in bad health, many being very bad. The Superintendent of the Lahore asylum urged the necessity of a work-shed in the dangerous ward, for criminal lunatics, and the Superintendent of the Delhi asylum brought to notice the want of a convalescent ward. Both matters were to be referred to the Public Works Department, with a view to the provision of these buildings.

Central Provinces.

The lunatics in confinement in the Nagpur and Jubbulpore asylums during 1886 numbered 342, of whom 43 were new admissions. At neither of the asylums was there any re-admission, which was attributed to greater care in discharging patients as improved. Fifteen patients were discharged cured before the close of the year, and 33 died. As in previous years, the bulk of the lunatics admitted at Nagpur were reported as suffering from acute mania or acute dementia, and at Jubbulpore from acute mania. Ganja smoking was very markedly, it is reported, the most common cause, as far as it could be ascertained, of the insanity of the patients admitted in 1886. The vital statistics of both asylums were very unfavourable. The mortality at Nagpur (23 deaths) was twice as great as in 1885, and greater than it has been since 1874, the chief causes being advanced age and bad health of patients on admission, accumulation of elderly patients, and dysentery and diarrhœa. At Jubbulpore the deaths, (10) were more numerous than in any of the previous 10 years, but, unlike Nagpur, there was not a single case of dysentery or diarrhœa. One single sporadic case of cholera occurred in the Jubbulpore asylum, the only case in the district throughout the year, the victim being a woman six years an inmate of the asylum, and who had never, so far as is known, been outside it. At Nagpur the lunatics did good work in keeping the environs of the asylum tidy, but the more hardy were

employed on farming and gardening, which they like; "they are not pressed at work, "yet they perform the whole of the out-door labour." At Jubulpore the patients were, as usual, employed in manufacturing operations.

The Tezpur lunatic asylum contained 66 inmates on the 1st January 1886, and in the course of the year 29 more were added, making a total of 95. Before the end of the year 16 patients were discharged as cured, 6 in improved health, 2 escaped, and 10 died. The mortality was very high, compared with 1 death in the previous year, and has only been equalled or exceeded twice since the opening of the asylum, and in a year free from epidemics, and when the daily average sick was lower than usual. This was owing to the number of cases admitted in a debilitated state from privation and exposure before entering the asylum, six of the deaths having occurred among patients who were admitted in advanced stages of disease. Dr. Eteson, the Sanitary Commissioner, visited the asylum during the year, when he found that the diet scale had been in use since 1873. This being old and obsolete, he gave directions for a new diet scale, and also gave instructions for remedying certain minor sanitary defects. He found that the inmates presented an excellent appearance physically as a rule, and that comfort and cleanliness were everywhere apparent. The cultivation and manufacture of sugar was extended during the year. Assam.

The number of patients under treatment in the Rangoon lunatic asylum during 1886 was 281, including 79 fresh admissions. Of these 24 were discharged cured, 9 were transferred to their friends in an improved mental condition, and 18 died. The health of the inmates of the asylum was below the average of previous years. The Superintendent states that they never had so many cases sent in a year in such a weak, reduced, or exhausted condition. Of the total 79 admissions, 19 were described as in very bad health, 47 as being in indifferent health, and the remainder as not well. The majority of the deaths occurred among patients who had been only a short time in the asylum. The occupation of the patients consisted chiefly in farming and gardening, which contributed greatly to the comfort, happiness, and restoration of many. Lower Burma.

Medical Schools.

The total number of medical students in Bengal rose from 752 in 1885–86 to 965 (including 29 females) in 1886–87. The increase was partly due to the opening of three new schools in Calcutta (the Calcutta School of Homœopathy, the Calcutta Medical Institution, and the Calcutta School of Medicine), and partly to increased attendance. Of this number 234 (including 24 females) were studying in the Calcutta Medical College, where, at the close of the session, 8 senior scholars and 4 paying students passed their final M.B. and L.M.S. examinations; 13 hospital apprentices passed, and left for regimental duties; one Burmese student passed and left for Burma; and the strength was further reduced to 172 by dismissal and other causes. The Maharani Swarnamayi's hostel was built during the year to half its proposed extent, and occupied by ladies studying medicine. It has since been made over to the Managing Committee of the Countess of Dufferin's Fund; half the cost of establishment will be borne by Government and the other half by the branch committee. The Campbell Medical School was attended by 229 students. For the first license examination 46 out of 53 secondary students passed, and of 50 who appeared at the second license examination 38 were successful. Ten licentiates of this school entered Government service. It is reported that the best educated of the students of this school do not enter Government service, but obtain employment on railways, in the employ of municipalities, in factories, in emigration depôts, and tea gardens, and that some of them have no difficulty in establishing lucrative private practice in mufussil stations and villages. At the Dacca Medical School there were 210 students on the rolls, and of these 48 appeared at the final examination of third-year students when 43 passed as hospital assistants. Advantage was taken of Her Imperial Majesty's Jubilee to raise subscriptions, which already amount to Rs. 50,000, for the erection of a permanent building for the school. The number of students at the Temple Medical School, Patna, was 126, of whom 41 were in their third year. Of these 34 went up for final examination, and 26 passed. The Cuttack Medical School had 49 students on its rolls, 11 being in the third-year class. Ten of these attended the final examination, eight of whom passed. During the year the authorities of this school experimentally opened a class for female students, when two European and three native ladies joined. Bengal.

The two Homœopathic schools at Dacca had 151 pupils, or six less than in the previous year. Some of the students who passed the final examination are reported to be successfully practising their profession in various districts of Bengal and Assam.

Madras.

There were 211 students on the rolls of the Madras Medical College on the opening of the session on the 1st October 1886, and four were admitted at the beginning of the summer session. The fresh admissions numbered 41. Of the 215 students 146 were in the senior department, of whom 26, including one female, were studying for M.B. and C.M. degree, and 120, including four females, for the L.M.S. degree. The results of the University examinations was looked upon as a failure, only 40 having passed out of 123 candidates. This contrasts strongly with the results of the previous year, when 61·2 per cent. of the candidates passed. The largest percentage of failures was in the primary examinations; of 78 who appeared for the first L.M.S. examination only 18 were successful, the failures having occurred chiefly in practical anatomy and chemistry. In the second L.M.S. examination 16 out of 34 candidates passed. The Director of Public Instruction reports that changes in the staff probably contributed partly to the failure; but he was inclined to think that insufficiency in practical instruction must have mainly contributed to the unsatisfactory results in the above subjects. In the second department there were 64 students, 18 of whom were females. The results of the primary and final examinations were very satisfactory, 14, including 3 females, out of 16 having passed in the former, and were placed in the second class, and 26 out of 43 in the latter, 11 being placed in the first class.

Altogether there were 23 female students, or 9 more than in the previous year. With the National Association for providing female medical aid to the women of India, of which the Countess of Dufferin is President, the appointments are more numerous than the candidates qualified to fill them. "This" the Director states, "will doubtless give much impetus to female medical education, the progress of which "is a matter of higher importance in India than in any other country in the world, "and he feels sure that the Madras Medical College will year by year gain such an "accession of pupils as will enable it to retain its position as the most forward insti-"tution in India for the training of women medically."

Bombay.

The attendance at the Grant Medical College, Bombay, fell from 296 in 1885–86 to 276 in 1886–87. Of these 20 were women, an increase of two on the number of the previous year. The results of the various University examinations in medicine were very satisfactory. In the first examination 59 candidates out of 87 passed, 7 being placed in the first class. In the second examination there were 84 candidates, of whom 43 passed, 7 being placed in the first class. For the L.M.S. degree, 16 candidates out of 36 passed, 2 being placed in the first class; and for the M.D. degree there was one candidate who passed. The Principal reported well of the female class, stating, "that the prospects "of some may be considered to be decidedly encouraging." He further reported that since the date of his report, 10 women, four of them the wives of soldiers, were receiving instruction at the Obstetric Institution. Six of this class, including two of the soldiers' wives, completed the course of study, and obtained certificates of qualification as midwives.

At the Government Medical Schools at Poona, Ahmedabad, and Hyderabad, the average attendance of pupils was 112. At the final examinations 28 students and 1 midwife passed, and several obtained employment in Burma and elsewhere.

Punjab.

During 1886 important alterations were made in the constitution of the Lahore Medical School. It was raised to the rank of a college, and arrangements were made to teach the students up to the standard of Bachelor and Doctor of Medicine, the Supreme Government having granted the power to give these degrees to the Punjab University, to which the college is affiliated. The name has, therefore, been changed from the Lahore Medical School to that of the Lahore Medical College and School. The students who are taught in the English class are now considered to be in the medical college, while those who are in the Hindustani class are included in the medical school. The total number of students at the close of the year was 211, an increase of 28 since the previous year, 68 being in the college department, and 143 in the school department. Of the college students 14 went up for the final examination, but only 7 passed in all subjects. For 35 scholarships in the medical school there were no less than 310 candidates, 89 of whom had passed the middle school examination in English, hence it was agreed that this examination should be compulsory in future. At the

final examination of school students, 32 out of 35 passed as hospital assistants. Of female students there were 3 in the medical college and 16 in the medical school, 5 of whom receive scholarships from the Countess of Dufferin's Fund. The senior female students in the school receive lectures and clinical instruction in the Female Hospital from Dr. (Miss) E. Bielby, besides being taught by the teachers of the school.

North-Western Provinces and Oudh.

The total number of students under instruction at the Agra Medical School during 1886–87 was 146, being an increase of 26 on the previous year. The school continues to maintain its high standard of proficiency. In the first class, consisting of 26 pupils, 17 did remarkably well, and obtained diplomas. Five female students also obtained diplomas. The latter are reported to be well-grounded in the principles of medicine and surgery, and on completion of a practical course in a hospital, which the Committee of Lady Dufferin's Fund have decided to give them, they will, it is expected, prove valuable practitioners. The second class consisted of 30 pupils, 11 being females. Of the 19 males, both the military and civil sections did well; but the female class as a whole somewhat disappointed the Principal. Of the total 146 students, 46 were females, 31 of whom were in the fourth or lowest class, two of them (Hindus) occupying the fourth and sixth places in the class numbering 69 students. In his report on the Civil Hospitals and Dispensaries for the year under notice, the Inspector-General speaks highly of the surgical work done by many assistant surgeons and hospital assistants, a large number of lithotomy and cataract operations being successfully performed by hospital assistants. "These facts," it is stated in the orders of the Local Government on the report, "speak highly for the "soundness of the training given by the Agra Medical College, on which the province "depends for its subordinate medical staff."

VII.—SANITATION.

(*Civil.*)

Bengal.

SATISFACTORY progress was made during 1886 in the work of reclaiming and improving the bustees of the town of Calcutta. Of 39 bustees taken in hand, 16 were completed, 4 were approaching completion, 5 had been commenced, and projects were approved for 5 more. Progress was also made in tank-filling, and in the erection of bathing platforms. Of the latter, 69 were in working order at the close of the year, or 28 more than in 1885; four others were completed, though not in working order, and five more were under construction, making a total of 78, nearly all of them being double, with separate apartments for women. These bathing platforms are reported to be very popular and most largely resorted to by the poorer classes. Much attention was given to the extension of the filtered water-supply of the town. Through improved means of communication the average daily supply was increased from 8,083,698 gallons in the preceding year to 9,112,648 gallons. By May of 1887 the supply had further risen as to average over 11 million gallons, and to occasionally exceed 12 million gallons a day, this being due to an increase in the working filter power at Pultah. The daily supply of unfiltered water had also increased from 1,670,941 gallons in 1885 to 1,868,572 gallons, and has since been further increased to $2\frac{1}{2}$ million gallons a day. Three special drainage works were in hand during the year, viz., the drainage of Hastings, of the Baug Bazar area, and the sewering of a portion of the Mahratta Ditch. The first of these is now complete, the whole scheme, including flushing arrangements, costing Rs. 89,000; the other two were in course of construction. The total length of sewers constructed in public streets was 12,651, and in bustee roads 9,834 feet. In addition to these 9,069 feet of sewers were relaid and repaired. The number of premises connected with the sewers during the year was 1,090, bringing the total up to 23,572.

Out of a total income of Rs. 30,84,571 the municipalities of Lower Bengal spent Rs. 11,92,389, or 38·65 per cent., on sanitary works, exclusive of roads, against 40·28 per cent. in 1885. As regards the interest taken by Municipal Commissioners in advancing the sanitary welfare of towns, the Sanitary Commissioner complained that nothing was done towards the removal of grave sanitary defects, while a great deal was laid out on education, lighting, and road watering. Amongst the more important sanitary works completed or in progress during 1886, were the extension of the waterworks at Darjeeling and the introduction of water-supply scheme at Jamalpore town, in Monghyr, at an estimated cost of Rs. 64,807; the Bhagulpore waterworks scheme was in progress. It is believed that these latter works will prove highly beneficial to the health of the townspeople, as the water-supply was bad. The estimated cost of the works is Rs. 2,67,353. A scheme for supplying Puri town with good drinking water was under the consideration of Government. The question of a filtered water-supply for Howrah had been so far prosecuted as to foreshadow a hope of ultimate success. The question of drainage received considerable attention, and in several places satisfactory progress was made in this direction. Conservancy was well attended to, and in a few towns the sale of refuse was commenced.

Madras.

In connexion with the Black Town drainage, a sum of Rs. 1,71,759 was expended by the Madras Municipality during the year, Rs. 1,00,000 of which was a contribution from provincial funds. In the course of the year 51,642 feet of surface drains were constructed, making a total up to the end of 1886–87 of 39·3 miles. The new water-supply scheme was at a standstill. Owing to a sufficient rainfall, the necessity of pumping water from the Red Hills tank into the delivery channel did not arise. The supply was improved by the construction of a new main from Kilpauk to Nungambaukum, and branches from it to certain other portions of the town. In all about $5\frac{1}{5}$ miles of pipes of all sizes were laid during the year.

No sanitary work of any special importance was undertaken or executed in the Madras Presidency during 1886, but much good work was done in the sinking and repairing of wells and in constructing and repairing of latrines, &c. The sanitary allotments in the municipalities for 1886–87 amounted to Rs. 6,48,473, or 35 per

cent. of the revenues, but of this amount only 58 per cent. had been expended during the nine months ending December 1886, against 70 per cent. in 1885. In the Local Fund Circles also out of a sanitary allotment of Rs. 3,64,601, less than a half (Rs. 1,80,434) was spent at the end of December. Notwithstanding this apparent apathy and indifference on the part of the Municipal and Local Fund Boards, the Sanitary Commissioner was of opinion that real progress was being made in sanitary matters, and that the local authorities were beginning to learn the importance to local interest of protecting public health. Special attention was given to the subject of village sanitation, and with the view of further improvement, the Sanitary Commissioner submitted certain proposals, comprising the distribution of simple rules on sanitation, translated into the vernaculars, to all village schoolmasters and others, and the teaching of hygiene in girls' schools.

Bombay.

In Bombay City fair progress was made with the Tansa water-supply scheme, which provides for a daily supply of 17 million gallons. During the year 417 new connexions were made, involving an increased consumption of over 2 million gallons a day. At this rate of increase great difficulty will be experienced in complying with the requisitions for new connexions up to the time when the Tansa water is available, which will be some years hence. A proposal for the raising of a loan of 25 lakhs of rupees in connexion with these works was under the consideration of the Government of India. The construction of the filter beds at Vehar was completed, as was also the raising of the dams of the Tulsi Lake, and though, owing to the heavy monsoon, the lake was filled to the point of overflow, it stood the test without showing any signs of weakness. With the view of making the very most of the existing water-supply, satisfactory steps were taken to detect and prevent waste of water—a daily waste of 600,000 gallons had been discovered—and it is expected that when the full sanctioned staff is employed, the saving will reach $2\frac{1}{2}$ million gallons, equal to one-sixth of the present supply. The construction of the storm water drainage works, including the reservoir on the Flats, had been most satisfactory in freeing the portions of the city affected by the works from flooding. Good progress was also made with the various drainage works of the city. The amount expended on drainage since 1878 was about 23 lakhs of rupees, and works to cost 21 lakhs when completed were in progress during the year. Many street improvements were also carried out. The Government of India have recently sanctioned the raising of a loan of 7 lakhs of rupees to carry out certain drainage and other sanitary improvements in the city.

Out of a total income of Rs. 31,32,776 in 1886-87 the municipalities in the Bombay Presidency spent Rs. 3,38,763 on conservancy. No new sanitary work of any great importance was undertaken during the year, but large sums were expended on constructing and improving drains, wells, and other sources of water-supply, latrines, &c. Several municipalities are reported to have allowed large balances to accumulate with a view to enable them to undertake important sanitary works. A scheme for improving the water-supply and drainage of Sukkur town was in preparation by Colonel Ducat, the Consulting Sanitary Engineer to the Government, who had also prepared a drainage scheme for Hyderabad City, estimated to cost 3 lakhs of rupees, which had been approved by the municipal authorities. In consequence of the growing unhealthiness of Poona City, a special committee was appointed to consider and report upon the best scheme for removing the various unwholesome conditions. Steps have also been taken to diminish as far as possible the injurious effects of excessive irrigated cultivation in the city and its cantonments. The General Department has submitted an exhaustive report, which was under the consideration of the Government. The Government had also called upon the Poona Municipality to take measures to improve the sewerage of the city. A scheme was also in progress for removing as far as possible the causes affecting the sanitary condition of the city of Ahmedabad, and sanction has since been given to the municipality to raise a loan of Rs. 3,00,000 in order to carry out part of the scheme for the supply of water to the town. A Bill relating to the conservancy of villages was under the consideration of Government, and good results are expected to follow its enactment.

Punjab.

In several districts of the Punjab important sanitary projects were either in progress or completed during 1886. Among these the more important were the Simla sewage scheme, the main line of which was laid and partly in use; the extra mural drainage channel for Amritsar, which was finished, and proved very effective during the rains; and the masonry drains at Anarkali. Good progress was made

with the Rawalpindi waterworks scheme, part of which was opened by the Lieutenant-Governor of the province on the 26th March 1887. It is estimated that the works, when finished, will have cost Rs. 2,52,330. Similar works for Delhi and Peshawar had received sanction, but were waiting the raising of loans for funds to carry them out. In the municipalities, Rs. 10,08,503 were spent on sanitary improvements, against Rs. 9,16,669 in 1885. Of the year's expenditure, Rs. 4,44,781 was on account of conservancy, Rs. 1,19,955 on drainage and sewerage, and Rs. 1,90,799 on water-supply. During his tour of inspection, the Sanitary Commissioner visited several towns and villages, when he pointed out to the headmen many sanitary defects which required removal, at the same time indicating the means by which they might be remedied. He states that a far more satisfactory state of things in the sanitary condition of villages might be brought about if it were possible to convince the influential men of the village of the importance of sanitation, and induce them to take a permanent interest in the matter. "But to do this is," the Local Government remark, "the difficulty the sanitary officer has to contend with; and it is not to be "expected that the simple agriculturist of the Punjab will readily turn from habits "which his forefathers for many generations have followed, and in which he can "see nothing hurtful or in any way objectionable, to adopt in their place other habits, "the advantages of which the lower orders of civilized Europe have hardly yet "perceived. It is therefore essentially necessary that all officers engaged on sanitary "work among the village communities of the province should be patient and "considerate in endeavouring to overcome the many insanitary arrangements and "customs to be found in and about a native village, but which the villagers "themselves look upon with anything but horror and disgust."

North-Western Provinces and Oudh.

No new sanitary work of any magnitude was undertaken in the North-Western Provinces and Oudh during 1886; but in most of the municipalities much attention was given to improvements in water-supply, drainage, and conservancy. In Dehra Dun a loan has been contracted for the purpose of supplying the town with pure drinking water, an example which the Sanitary Commissioner hopes soon to see followed elsewhere, as in this most important matter he considers the province is behind any other in India. "Although standing on the banks of rivers," he says, "the cities of Lucknow, Benares, Allahabad, Agra, and Cawnpore are still without a "supply of pure water. . . . . It is a reproach to the great cities of these "provinces that they should be anticipated by second-rate towns of other parts of the "country, in providing for their inhabitants this essential of comfort, cleanliness, and "health." Schemes for supplying these towns with a pure water-supply have already been considered, but want of funds prevent their being executed. As regards village sanitation, Dr. Planck states that no system of drainage can be said to exist, and that owing to the level nature of the village sites and the consequent want of fall, surplus water is very difficult to be got rid of; it stagnates and evaporates, or is absorbed by the soil. And of the water-supply of villages, he says, that it varies greatly, but only in the degree of its impurity. He suggested that many of the uncared-for wells might be closed up with great benefit to the public health, and that one or more selected for public use might be put in good repair, while much might be done towards improvement by the influence of district authorities. The Local Government pointed out that difficulties of ownership as well as of caste and association stand in the way of this proposal, and that they were not possessed with the power to give authoritative effect to it. The subject, however, was to be brought to the notice of district boards as a policy which might be advantageously promoted to the extent of the means and influence at their command.

Central Provinces.

There is little to record under the head of sanitary works in the Central Provinces. No new works were undertaken during the year, but much was done in improving the water-supply, drainage, and conservancy. The municipalities expended Rs. 2,54,135 or 33·7 per cent. of their income on sanitation, out of which Rs. 1,28,764 were appropriated to conservancy, and Rs. 12,359 to drainage. In the course of the year, 166 new wells were constructed, and 233 were repaired in the various rural circles of the province. The subject of village sanitation was engaging the attention of the Local Government. Rules regulating the conservancy and water-supply of villages, framed under the Land Revenue Act, were in force in certain selected areas, and the results of the first year's working were so encouraging that the Chief Commissioner decided "to extend very considerably the areas within which their "active enforcement shall be attempted."

The cause of sanitation met with considerable attention in Berar during 1886, though much yet remains to be done even in the larger towns, in the opinion of the Sanitary Commissioner, before the essential principles of sanitary science can be satisfied. Out of a total income of Rs. 1,66,333 the municipalities expended Rs. 86,521, or 52 per cent., on sanitary improvements, but principally on conservancy. In the civil stations, non-municipal towns, and villages, Rs. 93,685 were expended on sanitation, out of a total allotment for the purpose of Rs. 94,781. Rural Berar still remained in an unsatisfactory sanitary condition, "the usual "state of things being a pervious cesspool to every house, and where this is "wanting the house sullage flows on the street," the Sanitary Code which was issued some time ago, being almost entirely ignored. But village sanitation in Berar is beset with many difficulties; the people have no faith in sanitary measures, and are apt to regard epidemics as the visitation of a malevolent power. "Improvement must," the Resident believes, "commence at the top of the social "scale, and if district officers can directly, or through tahsildars, bring a legitimate "influence to bear, and induce some influential and wealthy native gentlemen to accept "the necessity for observing some elementary sanitary rules, the beneficial example "may in course of time spread, and permeate to the lower classes of society." Berar.

Sanitary work makes but slow progress in Assam. The only permanent work completed in 1886 was the Gauhati waterworks. A similar scheme for providing the municipality of Sylhet with a water-supply had been accepted by the Municipal Commissioners, and was in preparation. The drainage schemes at Gauhati and Goalpara were maintained during the year, and good work was done in supplying the town of Dibrugarh with good wells. In 20 towns, unions, stations, and municipalities, Rs. 85,050 were expended on sanitation; but excluding the amount spent on roads, there remained a little less than Rs. 50,000 for sanitary works of all kinds. The Sanitary Commissioner again reports favourably of the sanitary condition of the tea gardens. Assam.

The only sanitary work of any magnitude in hand in Lower Burma during 1886 was the land reclamation scheme at Rangoon, which was commenced in the previous year. A pneumatic drainage system for Rangoon was sanctioned, but the work could not be proceeded with for want of funds. This work, the Sanitary Commissioner states, is a necessary complement to the waterworks scheme which was completed in 1883, and until it has been carried out, the sanitary condition of Rangoon cannot be regarded as satisfactory. In most of the towns sanitary work consisted chiefly in maintaining existing conservancy arrangements, repairing existing works, and other minor improvements. The amount expended by the Public Works Department on sanitary work during the year was Rs. 41,052, of which sum more than a half (Rs. 25,944) was devoted to markets, and over a fourth to drainage. Rural sanitation was receiving the attention of district officers. In most of the districts something was done in the way of improving the sources of water-supply, and in making and repairing roads and culverts. The amounts contributed by the local funds for these purposes was not large, still "it is gratifying to find" the Government of India observe, "that a beginning has been made with a view to "extend the benefits of sanitation to the population of the rural tracts of the "country." Lower Burma.

(*Military.*)

A sum of Rs. 63,49,628 was expended on military sanitary works in the Bengal Presidency during 1886–87, nearly a half of which was devoted to original works. An unusually heavy amount of work was executed at Quetta, consisting chiefly in the construction of barracks and subsidiary buildings. At several other stations works of more or less importance, having for their object the health and comfort of the troops, were either carried out or in hand. Bengal.

No new works of any great importance were undertaken in the Madras Command during the year, beyond the construction of additional barracks and latrines. Several works were, however, in contemplation, but want of funds prevented their being carried out. On the whole, the general sanitary condition of the barracks and buildings were reported as satisfactory. Madras.

The outlay on military sanitary works in the Bombay Command in 1886 amounted to Rs. 2,48,433, of which Rs. 1,18,203 were spent at Bombay and Colaba. The Bombay.

Ghorpuri barracks at Poona were improved, and a better system of drainage effected. At Karachi over Rs. 25,000 were expended on waterworks for supplying water to the troops in the cantonment. The long contemplated project of an artificial lake for Mhow was being energetically carried out. "It is proposed to carry the water "by a 10-inch pipe to a tank in the infantry lines, the highest part of the cantonment, "and thence distributing it by gravitation to all the civil as well as the military "occupants. This will have a most beneficial influence on Mhow, rendering it a "more desirable place than ever. Not only would the constant fear of a water "famine be entirely removed, but the distribution of pipes would in a great measure "do away with the bhistie and his mussack, so often to be viewed with suspicion, "and there would always be water available for gardens and trees, and for the "dusty roads."

While the present Report was passing through the press the following Resolution on the "Practical Application of Sanitary Principles to Towns and Villages in India" was issued by the Government of India to the several Local Governments and Administrations for their guidance:—

"RESOLUTION.—The practical application of sanitary principles to towns and villages in India has since the publication in 1863 of the Report of the Royal Commission on the Sanitary State of the Army in India received the continuous attention of the Government. The Report of the Royal Commission, the reports submitted subsequently from time to time by the various Provincial Sanitary Commissioners, and the suggestive reviews of those reports which have emanated from the Army Sanitary Commission in England, have brought to notice the chief sanitary defects of urban and rural areas, and have indicated the methods by which they might be remedied. It is through no want of sympathy with the cause of sanitary improvement that the Government of India has not been able hitherto to give as full effect to these recommendations as it could have wished. The difficulties to be overcome were numerous and formidable, and lay, to begin with, as much in the ignorance of the people and in the passive resistance offered by them to all departures from the practice uf ages, as in the wants of funds and the absence of an executive agency to give effect to the orders of the central authority. However convinced the Government of India might be of the value of the suggestions made for its adoption, and however anxious to carry them into effect, it had to proceed with circumspection, and with a due regard to the means at its disposal as well as to the prejudices of the heterogeneous populations entrusted to its care. Under such circumstances progress has unavoidably been slow. Still considerable progress has been made. The ignorance of the people on all sanitary questions has been in some measure mitigated by the Department of Public Education, which has imported into the ordinary school curriculum instruction in the elementary principles of sanitary science. Popular prejudices have been combated by the judicious influence of the officers of Government, and by the introduction of improved sanitary methods, wherever this was practicable. Sanitary Commissioners have been appointed in all provinces; information regarding the sanitary needs of towns, and later of rural areas has been collected, and in many municipalities and some rural areas this information has been turned to account in the provision of a pure water-supply, of improved drainage, and of better conservancy arrangements. The Government of India readily admits that what has been done in these directions may appear small in comparison with what remains to be done. But it does not admit that, having regard to the difficulties which lay in the way, reasonable progress has not been made.

"2. It has been stated that the main obstacles which have hitherto impeded sanitary improvement in India lay in the ignorance of the masses and their dislike to any change of custom, in the want of efficient executive agencies, and last, though not least, in the want of funds. Upon the first of these obstacles, the Governor-General in Council does not on the present occasion desire to dwell. It indeed still constitutes a formidable difficulty, upon which, in rural areas at all events, little sensible impression has yet been made, and its existence renders it necessary still to observe great caution in the introduction of sanitary reforms. But with the rapidly advancing tide of popular education, the perception of the beneficent intentions of the Government comes home more clearly to the people than it did; and there is less danger than there was that measures taken for the improvement of the health of the people and the prevention of disease should be misconstrued as arbitrary interference with time-honoured practices. If some years ago it was generally and correctly felt by

Local Governments and Administrations that authoritatively to press the subject of sanitary improvement, especially in villages, would be of little avail, and that persuasion, not coercion, was the right plan to follow, it is no less generally felt to-day that a more forward, though still cautious and tentative, policy would now be opportune.

"3. In considering, therefore, the measures most calculated to promote the cause of sanitary reform in India, attention should, in the first place, be directed to the question of executive agencies, and to the question of funds. Taking the question of executive agency first, it has to be regarded in its relation to urban and to rural areas. In relation to urban areas, the Governor-General in Council is glad to think that the question now presents far less difficulty than it did. When sanitary reform in India received its first impetus from the investigations of the Royal Commission referred to in the preamble, there was, outside the presidency towns, practically no organization for the prosecution of sanitary work. The hardworked district officer did what he could to keep his towns clean; but sanitary science in India was then in its infancy, while the most enlightened inhabitants of Mofussil towns knew nothing about it, and never troubled themselves to learn anything. The result was manifest in the lamentable state of things depicted in the Report of the Royal Commission. Since then, however, there has been much improvement. The growth of the spirit of self-help and the perception of the advantages of sanitation in municipalities has in recent years been encouraging; and there is reason to think that the Government may with increasing confidence rely on the co-operation of municipal bodies in promoting sanitary reform. The Municipal Acts, which formerly were adapted to an early stage of civic development, have now been cast in an ampler mould. Those now in force in the various provinces confer a larger discretion and authority to pass rules and byelaws for sanitary purposes, and impose upon Municipal Committees the duty, as far as the funds at their disposal will permit, of providing, among other things, for the sanitation of the towns. Municipal Boards can, therefore, both entertain the requisite agency for carrying out the law, and raise the necessary funds. The areas to be dealt with are limited, and with them the interests of the people affected are mostly identical. There is a field for concentrated effort; and the Government may therefore with greater confidence look to Municipal Committees for active assistance in carrying into effect the measures of sanitary improvement declared to be necessary for the towns over which they preside.

"4. In rural areas the case is different. Among the village population the sense of the need for sanitary reform is but little, if at all more developed than it was when the Royal Commission reported a quarter of a century ago. The great feature of Indian rural life is immobility of custom, upon which novel ideas make but little impression. For improving the sanitation of villages executive rules have been from time to time framed and recommended for general adoption. It does not appear, however, that they were anywhere productive of much good, for there was no executive agency to supervise their working, or, when necessary, enforce them.

"But in this important matter of executive agency a great improvement has been effected by the District and Local Boards Acts passed by the Legislative Council of the Governor-General and by the various local legislatures. In the Madras Presidency a gradation of rural Boards has been established, one of which deals with the village, another with the subdivision of a district; a third with the entire district. All these Boards have their special functions to discharge, but each has to provide within the area of its jurisdiction for the sanitation of towns and villages, and to that end is endowed with powers to entertain the necessary establishments. In Bengal and the Punjab the organisation established, or to be established, is on the whole similar to that established in Madras, and though under the system introduced in Bombay, the North-Western Provinces, and Central Provinces, a larger territorial unit of self-government has been adopted, there is no reason why the executive agencies should not act effectively throughout the larger areas. The various Acts of the Legislature, which create this system of local self-government, require the Boards to undertake, among other things, local works and measures likely to promote the health of the public within the area subject to their authority, and empower them to entertain establishments for that purpose. In some instances also the laws creating these bodies confer upon them limited powers of taxation. But when this is not the case, or when it may be inexpedient to resort to taxation, or when funds may be insufficient to meet the expenditure necessary for sanitary and other improvements, it is always open to the Boards, with the sanction of the Local Government, to have recourse to loans under Act XI. of 1879 (The Local Authorities Loan Act).

"This legislation has therefore provided the Government of India, for the first time, with the means of creating that agency for executing sanitary reform in rural areas without which its previous exertions proved comparatively fruitless. The agency, even in the provinces in which it has been established, is as yet in its infancy; but year by year it will grow stronger and more efficient, and the Governor-General in Council therefore desires to impress upon Local Governments that, from the beginning, the promotion of sanitation should be regarded as one of the most important duties of all District and Local Boards, and of Village Unions, where they exist.

"5. In initiating and carrying approved sanitary measures into effect, it will be always essential to enlist the assistance and co-operation of the district authorities, which indeed are always available to Municipalities and Local Boards. But it must be remembered that district officers, who have generally shown themselves forward in promoting sanitary improvements and in co-operating with Local Boards in these matters, have neither the time nor the technical knowledge, nor the opportunities requisite for a comprehensive survey of the entire field of activity which is necessary for the discharge of the duties in question. Experience in India as well as in other countries has shown that, unless local executive agencies are carefully guided and controlled in sanitary matters, there is almost certain to be misdirection of energy and wasteful expenditure. As has been pertinently observed, "it is vain to hope that the "numerous public bodies to which the sanitary administration of India has been "committed will be found competent to discharge their important duties, so long as "there is no competent authority possessing the necessary knowledge and armed with "the necessary powers to assist their deliberations, guide their actions, and, when the "occasion arises, correct their mistakes and remedy their inactivity." It therefore appears to the Government of India to be eminently desirable that there should be established in each province a Sanitary Board, through which the Local Government can operate, and to which, subject in all respects to the orders of the Local Government, shall be entrusted the control and supervision over sanitary works, whether undertaken in urban or rural areas. It was one of the recommendations of Lord Stanley's Commission, referred to in the preamble to this Resolution, that a Commission of Health should be appointed at the seat of each Local Government, with purely consultative functions, to advise on all questions relating to sanitation. Something more than a consultative body is, in the opinion of his Excellency in Council, now required; and the Sanitary Boards which he wishes to create should therefore from the outset receive recognition, not only as a consultative body, but also as the executive agency through which the Government acts in the Sanitary Department.

"These Sanitary Boards might be composed of an officer of approved administrative experience, the Sanitary Commissioner for the province, and an officer of the Public Works Department skilled in sanitary engineering. With these three officers might be associated one or more non-official members appointed by the Local Government. Every Commissioner of Division in Northern India and Bombay, and possibly District Collectors in Madras, might also be *ex-officio* members of the Board when dealing with questions connected with their divisions or districts. It is probable that the duties of the Board would not, at all events for some time to come, be onerous, and could well be combined with the other and ordinary duties of the members.

"Finally, it is desirable that the Provincial Sanitary Boards should, subject to the orders of the various Local Governments, be in constant communication with the Sanitary Commissioner with the Government of India, whose advice upon large schemes of sanitary reform will always be useful, and who will be in a position to communicate to one Provincial Board the results of experience gained by another. The Sanitary Commissioner with the Government of India, who acts under the general instructions of the Home Department, will thus, so far as may be needed, exercise the functions of a general co-ordinating and consultative authority; and through him the Government of India will be in a position to enforce, if necessary, that general control which it is competent to exercise over all branches of the administration. It may afterwards be necessary to associate with the Sanitary Commissioner an expert in sanitary engineering science, but this is a question which need not be raised in this place.

"6. In orders issued by the Home Department on Municipal and Local Board reports for 1885–86, cited in the preamble to this Resolution, the Governor-General in Council took the opportunity of laying down the general lines on which, in his opinion, future action of local bodies should be directed in promoting sanitary reform. The principle which he had in view was, that action should be preceded by an accurate ascertainment of the requirements of each locality. Accordingly it was suggested to various Local Governments that a sanitary survey of each municipality and rural area should be

undertaken with as little delay as possible, and that plans and estimates should be prepared of all the improvements necessary to provide each town or village with an efficient system of water-supply, drainage, and conservancy. The most important of these requirements, and that which, in the opinion of the Government of India, may at first be dealt with most effectively, and with the greatest chance of the active assistance and sympathy of the people, is the provision of pure water. Drainage—especially in those localities in which the construction of public works, such as railways and canal embankments, have interfered with the natural flow of water, and may have injuriously affected the people's health—is also a matter calling for early attention. But while thus indicating the directions in which sanitation can be best promoted, there is on the part of the Governor-General in Council no desire to limit the discretion of Local and Provincial authorities as to their choice of action. That can best be determined by a knowledge of local requirements. In the orders in question it was added that plans, when once fixed, should be executed from year to year as funds become available, the object aimed at being persistently kept in view until it was completed. The Government of India desires in this place to call special attention to these instructions, which were devised with the view of checking wasteful recurring expenditure; and to express the hope that the annual reports on the Administration of Municipalities and Local Boards in each province will henceforward shew that progress is being made in the desired direction.

"Another important matter to which attention must here be called is the provision in every province of simple rules for the regulation of village sanitation. In some provinces such rules have been for some time in operation, though with no very beneficial result, while in others it is now in contemplation to render such rules more effectual by legislation. Wherever the existing law makes no provision, or insufficient provision, for the enforcement of necessary sanitary measures in rural areas, there should be no hesitation in taking the necessary power by legislation. And in this connexion His Excellency in Council thinks it may be of advantage if the attention of all interested in sanitation is again called to the valuable remarks made in 1879 by the Army Sanitary Commission on the practical application of sanitary principles to towns and villages in India. Their remarks are, therefore, published as an appendix to this Resolution.*

"7. Passing from the organization of the Sanitary Department to the important question of the provision of funds, it is in the first place to be observed that the various Municipal Acts enable the corporate bodies created by these Acts to raise by local taxation the funds necessary for local expenditure. Similar power is conferred on Local Boards by the Madras, Bengal, and Punjab Local Boards Acts, but apparently not elsewhere. It will be for the consideration of the Governments of Bombay and the North-Western Provinces and Oudh, which possess Legislative Councils, whether legislation should be undertaken with a view to confer powers of taxation upon Local Boards in those Provinces. Meanwhile, it is incumbent on the Governments of the provinces in question to place Local Boards in possession of funds sufficient to meet the reasonable requirements of local sanitation. But though sufficient money to meet current expenditure may be provided in these ways, it will probably be necessary to raise additional funds for the execution of new or large works. It is indeed probable that local income may be increased without any hardship to the tax-payers. In certain provinces some productive methods of municipal taxation have not yet been turned to account; but even when all current revenue is taken into account, it may, and doubtless often will, be found necessary to have recourse to loans under Act XI. of 1879, or to appeals to the Provincial or Imperial Governments for grants-in-aid of local resources.

"With reference to loans, the Govenor-General in Council desires to say, that so long as borrowed money is not spent on the ordinary current operations of a Municipal or Local Board,—so long as it is spent on works of lasting utility, there can, as a matter of principle, be no objection to imposing on the ratepayers of future years an obligation to subscribe. The Local Authorities Loan Act, XI. of 1879, affords certain facilities for borrowing by public bodies; but the rates of interest at which these bodies can raise the loans in the open market are often so high as to be practically prohibitive. The Governor General in Council has, therefore, taken the subject of loans to local bodies into his careful consideration, being satisfied that no policy of sanitary reform in India can be successful unless facilities are provided for local bodies

* Not reprinted. *See* "Report on Sanitary Measures in India, 1877–78," Vol. XI., p. 215. [C. 2415.] 1879.

to raise funds for sanitary improvements on less onerous terms than they at present can do. The Government of India has not yet come to a final conclusion on this important subject; but it is not indisposed to think, that when expensive works of the kind in question have received the previous approval of Government, and when sufficient control over the local finances has been reserved to ensure the fulfilment of the conditions on which the raising of the loan is sanctioned, it might be expedient to authorise Local Governments, subject to certain prescribed limitations and conditions, to raise and establish a provincial loan fund, and make its own bargains with local bodies in regard to advances necessary for sanitary improvements and other works of lasting utility. The question is one of general policy, which demands careful consideration; but the decision upon it will not now be long delayed.

"8. With reference to the subject of contributions from provincial funds for sanitary works of utility, His Excellency in Council has observed with satisfaction that a willingness has already been exhibited to contribute from provincial resources in aid of sanitary improvements, both in urban and rural areas. Where the ability of local bodies to raise loans is undeveloped and their credit not established, the Goverment of India approves of such contributions, and would like to see regular provision made for them in provincial budgets, when this can be done with a just regard to other demands on Local Governments. In some cases—such, for instance, as obstructed drainage, incidentally referred to in paragraph 6 above, as resulting from great public works—contributions would be obviously appropriate. But if contributions are to take a definite place in the plan of provincial finance, His Excellency in Council would be glad to see them systematised on the grant-in-aid principle, which has been found so effective in promoting education, care being taken to so regulate the distribution of the grants as to minimise the evils, inherent in the grant-in-aid system, of weakening local responsibility and fostering extravagance in expenditure.

"Under the system indicated above it will, it is hoped, be possible to meet from local resources the money necessary for local sanitary improvements. There may however be very exceptional cases the requirements of which cannot be met from Local or provincial resources or by loans. In such rare cases the Government of India will not refuse to consider applications from Local Governments in the interests of sanitary improvements of more than local importance."

India Office,
September 1888.

W. T. Ronson.
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ABSTRACT

OF

SANITARY AND OTHER REPORTS

FOR

1886.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA.

(Sir B. Simpson, M.D.)

European Troops.*

Though the number of admissions among the European troops in 1886 was less than in the previous year, the mortality was greater, and there was a larger proportion of serious cases. The two latter facts are, without doubt, due to the indirect influence of the military operations in Upper Burma upon the garrisons in Lower Burma, all of which are in the Madras Command. Without this indirect influence of active service in Upper Burma, the health of the European garrison of India would have been better than in the previous year.

Abstract of Statistics of European Troops in India for the last nine years 1878 *to* 1886, *and for the ten-year period* 1870–79.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	577,416	1,475	60	19·34	43	62
1878	56,475	1,651	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33‡	45
1883	55,525	1,336	63	10·88	33	44
1884	54,996	1,513	67	12·56	32	44
1885§	56,967	1,533	71	14·55	23	37
1886§	61,015	1,514	75	15·18	21	36

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.
‡ Calculated on the strength obtained from Annual Returns. § Excluding troops on active service in Burma.

The admission-rate, though lower than in the previous year, was higher than in any other year since 1881, and also higher than the average of 1870–79. The daily sick-rate is the highest in the above table except that for 1879. The death-rate was the highest since 1881; but it was over 4 per 1,000 less than the average of 1870–79. Madras, which includes the garrison of Burma, was the chief contributor to the increase of the death-rate. The loss to the army by invaliding was, on the other hand, much less than usual, as may be seen from the above table. The chief diseases causing invaliding were in order, circulatory diseases, anæmia and debility, phthisis, hepatitis, syphilis, dysentery, injuries, mental affections, rheumatism, and ague and malarial cachexia. Of these ten, the ratios, as compared with those of the previous year, were higher only in the case of circulatory diseases, syphilis, dysentery, and rheumatism. The total loss to the army from death and invaliding was 36 per 1,000, a ratio lower than that of any other year in the above table.

In the Bengal Presidency there was a substantial reduction in the admission-rate (from 1,661 per 1,000 in 1885 to 1,559 in 1886), while the daily sick-rate (73 per 1,000) remained unchanged. On the other hand, the death-rate (15·52) increased by over 2 per 1,000. In other words, though diseases were less prevalent, the number of serious cases was greater. The death-rate from cholera (0·64) was much less than in 1885, while the rates of death from enteric fever, malarial fevers, dysentery, hepatitis, respiratory diseases, and phthisis were higher than in 1885. The loss by invaliding was 2 per 1,000 less than in the previous year, and 23 per 1,000 less than the average of 1870–79. The total loss from death and invaliding was 1 per 1,000 more than in 1885, and 28 per 1,000 less than the average of 1870–79.

The health of the British troops in the Madras Presidency was less favourable than in the previous year. The admission-rate (1,380 per 1,000) was higher than it had

* Excluding troops on active service in Burma, returns for which have not been received in full.

been since 1879, and higher than the average of 1870–79; the daily sick-rate (82 per 1,000) was much higher than in any other year; while, although the mortality from cholera (0·09) was less, the death-rate from other causes (16·37) was nearly twice as great as in 1885, and greater than the average of 1870-79. Among the chief diseases which gave rise to increased admission-rates were enteric fever, remittent and simple continued fever, bowel diseases, hepatitis, and venereal diseases; and it was mostly the same diseases which caused the increased mortality. The loss to the Madras Army by invaliding was the same as in 1885, and 25 per 1,000 less than the average of 1870–79; the total loss from death and invaliding, 40 per 1,000, though greater than in 1885, was not unusually great, and was 27 per 1,000 less than the average of 1870–79.

In the Bombay Presidency the admission-rate (1,490 per 1,000) was practically the same as in the previous year, but was accompanied by a higher daily sick-rate (73 per 1,000 against 68 in 1885). That the cholera mortality (0·36) was reduced to a nineteenth of what it was in the previous year, and the total mortality (12·67) to about a half, was due entirely, or almost entirely, to the transfer of the Southern Afghanistan force from the Bombay to the Bengal Command from 1st April 1886. There was an increase of the admission-rates, among others, in enteric fever, remittent and simple continued fever, phthisis and venereal disease, and of the death-rates in enteric fever, hepatitis, and circulatory diseases. The loss to the Bombay Army by invaliding (28 per 1,000) was 1 per 1,000 less than in the previous year, and 15 per 1,000 less than the average of 1870–79. The total loss from death and invaliding, 41 per 1,000, was 12 per 1,000 less than in 1885, and 17 per 1,000 less than the average of 1870–79.

Southern Afghanistan was transferred from the Bombay to the Bengal Command from 1st April 1886. Its vital statistics for the first three months of the year are, therefore, incorporated with those of the Bombay Presidency, and for the last nine months with those of the Bengal Presidency. The following table shows an immense improvement in 1886 in every item except the admission-rate. This points to the prevalence of comparatively mild forms of disease.

Period.	Average Strength.	Ratio per 1,000.						
		Admissions.	Daily Sick.	Deaths from			Invaliding.	Total loss.
				Cholera.	Other Causes.	Total.		
1884	1,441	2,056	83	27·07	41·63	68·70	23·30	92
1885	1,672	2,187	94	42·46	40·67	83·13	28·59	112
1886	1,752	2,442	73	0·57	19·41	19·98	11·41*	13

* On weekly strength.

The increase of disease, as compared with the previous year, was under the heads of malarial fevers, spleen diseases, heat-stroke, alcoholism, scurvy, and abscess and ulcer mostly; while there were smaller ratios of admission from cholera, enteric fever, and venereal diseases, among others. Only enteric fever, heat-stroke, alcoholism, circulatory diseases and injuries gave rise to higher mortalities, while the death-rate from cholera fell from 42·46 to 0·57; that from dysentery from 14·95 to 1·71, and that from respiratory diseases from 8·37 to 1·14. There was, in fact, only one death from cholera, against 71 in the previous year. About 37 per cent. of the deaths were from enteric and remittent fevers.

The chief causes of admission into hospital in the three presidencies are shown in the following table:—

Bengal.	1886.	1870–79.	Madras.	1886.	1870–79.	Bombay.	1886.	1870–79.
1. Malarial fevers*	491	607	1. Venereal diseases	394	198	1. Malarial fevers*	472	660
2. Venereal diseases	394	209	2. Malarial fevers*	260	266	2. Venereal diseases	371	191
3. Injuries	120	91	3. Injuries	134	101	3. Injuries	124	95
4. Abscess and ulcer	91	82	4. Abscess and ulcer	95	108	4. Abscess and ulcer	79	97
5. Respiratory diseases†	62	84	5. Dysentery	71	77	5. Respiratory diseases†	62	64
6. Diarrhœa	58	62	6. Diarrhœa	60	65	6. Diarrhœa	46	61
7. Rheumatism and neuralgia.	43	62	7. Respiratory diseases†	50	57	7. Rheumatism and neuralgia.	38	49
8. Dysentery	28	33	8. Rheumatism and neuralgia.	39	46	8. Dysentery	23	28
9. Hepatitis	21	47	9. Hepatitis	36	67	9. Hepatitis	17	41
Total of the nine	1,308	1,277	Total of the nine	1,139	985	Total of the nine	1,232	1,286
Total from all causes	1,559	1,522	Total from all causes	1,380	1,264	Total from all causes	1,490	1,533

* Including simple continued fever. † Including tonsillitis and sore throat.

Malarial fevers, it will be seen, caused a large proportion of the sickness in all three presidencies. In Bengal and Bombay the ratios for 1886 were less, and in Madras greater than those of 1885. In all three presidencies the ratios were below the decennial averages of 1870–79, which were for Bengal 607, for Madras 266, and for Bombay 660. The foot note to the above table shows that simple continued fever has been included in malarial fevers. The proportion included was greatest in Madras, and least in Bengal. As usual, venereal diseases head the list in Madras. As compared with those of the previous year, the ratios of all three presidencies increased, that of Bengal by 31 per 1,000, that of Madras by 44, and that of Bombay by 99. With regard to venereal diseases, all three presidencies were also above the decennial average of 1870–79, Bengal by 185, Madras by 196, and Bombay by 180. In 1886 the venereal ratio was the same in Bengal as in Madras. A foot note to the above table states that tonsillitis and sore throat are included, as usual, in respiratory diseases. In all three presidencies the ratio of admission from respiratory diseases proper was below both that of the previous year and the average of the decade 1870–79. The improvement with regard to these diseases in the case of Southern Afghanistan has been already noticed. As in the previous year, rheumatic affections where somewhat more prevalent in Bengal than in Madras, and in Madras than in Bombay; but the ratios in all three were reduced, as compared with the preceding year and with the decade. As usual, dysentery and hepatitis were much more frequent in Madras than in either Bengal or Bombay. The diseases given in the table maintained the same order of prevalence as in 1885, except that in the Madras Presidency diarrhœa took the 6th instead of the 8th place.

The chief causes of mortality in the three presidencies are stated and contrasted in the following table, wherein the names of the diseases stand in the order of their mortality for the Army of India in the decennium 1870–79 :—

Deaths from	Bengal.				Madras.				Bombay.			
	1886.*	1885.*	1880–84.	1870–79.	1886.*	1885.*	1880–84.	1870–79.	1886.	1885.	1880–84.	1870–79.
Cholera - - - - - -	0·64	1·17	2·33	4·18	0·09	0·19	0·91	1·63	0·36	6·92	0·32	1·53
Hepatitis - - - - - -	1·26	0·88	1·28	2·04	2·50	1·04	1·66	3·16	1·18	0·70	1·10	1·71
Enteric fever - - - - -	5·70	4·05	2·88	2·28	3·85	2·19	1·71	1·42	4·16	2·54	2·82	1·75
Apoplexy and heat-stroke - -	0·88	0·91	1·64	1·53	0·90	0·38	0·76	1·42	0·91	1·14	1·49	1·56
Dysentery - - - - - -	0·90	0·34	1·00	1·37	2·77	0·38	0·55	2·32	0·63	2·89	1·54	0·98
Remittent and simple continued fevers.	0·83	0·57	0·91	1·74†	0·89	0·19	0·21	0·62†	0·27	1·49	1·36	1·14†
Total of the six - -	10·21	7·92	10·04	13·34	11·00	4·37	5·80	10·62	7·51	15·68	9·63	8·67
All causes - - - - -	15·52	13·16	16·17	21·00	16·46	9·13	10·02	17·69	12·67	23·82	16·92	15·27

* Excluding troops on active service in Burma.

† Including deaths from intermittent fever.

The highest ratio for all three presidencies was that of enteric fever, which also in all three was higher than that of the previous year, and than the average of the period 1870–79. Next came the hepatitis ratio, which, as usual, was highest in Madras. It was in all three below the decennial average, but above the ratio of 1885. Cholera mortality was very low. The great decrease in the case of Southern Afghanistan has already been noticed. In malarial and simple continued fevers and in dysentery, Madras alone was worse than in 1885, and than the decennial average, while Bengal was worse only as compared with the previous year, and Bombay better than for either period. It was in the case of Madras, and to a less extent in that of Bengal, that the indirect influence of the military operations in Burma was felt, as has been already mentioned, chiefly in consequence of the transfer of the Southern Afghanistan force from that Command. The Bombay Presidency shows a great improvement in its ratios, which, with the exception of that of enteric fever, were all below the decennial average, and with the exception of enteric fever and hepatitis, were all below those of the previous year.

The geographical groups into which the Bengal Army has been divided (excluding convalescent depôts, in which small bodies of troops are located for a few months of the year only) are enumerated in the following table, together with their admission and death-rates for a series of years :—

Period.	Ratio per 1,000 of strength.													
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilkhand.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860–79‡	1,566	22·00	1,512	24·32	1,518	22·46	1,850	28·45	1,794	22.98	1,056	13·50	1,638	25·49
1860-69	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	14·78	1,755	29·98
1870-79	1,311	14·43	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·23	1,522†	21·00†
1880*	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,253	20·75	1,813	27·73
1881*	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05
1882	1,187	11·19	1,699	22·61	1,613	8·86	1,891	10·51	1,796	12·12	975	8·65	1,579	13·17
1883	1,011	9·10	1,474	17·04	1,528	10·56	1,497	14·27	1,601	9·47	1,454	6·33	1,463	11·21
1884	1,195	10·97	1,381	14·72	2,028	17·01	1,874	15·53	1,992	9·75	1,201	5·91	1,662	11·68
1885	1,449	13·09	1,539	15·23	2,463	18·00	1,687	10·93	1,566	12·67	1,395	9·50	1,661	13·16
1886	1,675	15·46	1,630	17·09	1,902	16·68	1,526	15·91	1,442	16·64	1,219	10·27	1,559	15·52

* Excluding troops in Afghanistan and on the march. † Including troops in Afghanistan and on the march.
‡ Approximate averages.

The ratios of the second and third groups exceeded the Presidency ratio, both in admissions and deaths. Comparing the ratios of the six groups with the *approximate* averages of the 20 years 1860–79, we find that sickness was more prevalent than usual in the first, second, and third groups, and especially in the third or Meerut and Rohilkhand group; while mortality was less in all the groups. As compared with their condition in the previous year, the first and second groups had increased sickness, while all the groups, except the third, had increased mortality, especially the fourth. The increased sickness in the first and second groups was under many heads, among which were enteric and simple continued fevers. The greatest increase of mortality in the fourth group was in enteric fever and phthisis; and the greatest reduction of mortality in the third group was in enteric fever, phthisis, and circulatory diseases. Malarial fevers and venereal diseases in all groups contributed most largely to the total admission-rate. The total ratio for ague, remittent, and simple continued fevers varied from 820 in the third to 218 in the sixth group. The ague-ratio ranged from 760 in Meerut and Rohilkhand to 145 in the Hill Stations; the remittent ratio from 26 in Agra and Central India to 2 in Meerut and Rohilkhand; and the simple continued fever ratio from 259 in Bengal Proper to 58 in Meerut and Rohilkhand, and in Agra and Central India. The highest venereal ratio was 457 in Bengal Proper; but the ratios of the other groups were all above 400, except that of Agra and Central India, which was 359. With regard to enteric fever, the Hill Stations and the Gangetic Provinces stood highest, with a ratio each of 31. The highest ratio for dysentery was 45 in Bengal Proper, and the lowest 19 in the Hill Stations, and 24 in the Punjab; the highest for hepatitis 37 in the Gangetic Provinces, and the lowest 14 in the Hills, and 17 in the Punjab; and the highest for respiratory diseases 41 in Agra and Central India, and the lowest 30 in Meerut and Rohilkhand.

Though the death-ratios of all the groups were considerably below the approximate averages of the 20 years 1860–79, yet the Meerut and Rohilkhand group is the only one whose ratio did not exceed that of the previous year, as has been noted in the preceeding paragraph. Since the year 1879 the approximate average of 20 years has never been exceeded in the first and fourth groups, and has been exceeded only once in the second, third, and sixth groups, and twice in the fifth. The mortality of the Agra and Central India group is that which has risen most as compared with the previous year, the increase being, as already noted in the preceeding paragraph, chiefly due to enteric fever and phthisis.

In all the groups without exception the greatest mortality was from enteric fever, and, except in the case of the Gangetic Provinces and of Meerut and Rohilkhand, the ratio was higher than in the previous year. This increase was most marked in the case of Agra and Central India. All the groups recorded higher rates of mortality from enteric fever than the decennial average of 1870–79, the first group by 2·48, the second by 3·01, the third by 2·23, the fourth by 5·32, the fifth by 4·44, and the sixth by 4·10.

Confining attention to those only of the stations in which the average strength exceeded 200, and which were occupied throughout the year, the highest admission-rates were recorded at Thayetmyo (3,005 per 1,000) and at Barrackpore (2,789). At 10 other stations the admission-rates were over 2,000. In no station was the admission-rate under 1,000. The smallest ratios were recorded at Kirkee (1,116) and at Belgaum (1,132).

The highest mortalities occurred at Thayetmyo (56·27) and at Jhansi (44·44). In 12 stations the ratios were between 20 and 30 per 1,000, in 22 between 10 and 20, and in 17 under 10. The lowest death-rates were at Kamptee with Sitabaldi (3·39) and at Bellary (3·66). The Thayetmyo ratio is derived from 22 deaths to a strength of 391, 3 deaths each being from dysentery, heatstroke, and remittent fever, 5 from hepatitis, and 2 from enteric fever. At Jhansi, with a strength of 495, there were also 22 deaths, but of these no less than 14 were from enteric fever and 4 from cholera. In 1885 Jhansi, with a strength of 361, had no deaths. It received an accession of strength on the abandonment of Morar and Fortress Gwalior, of which the former had had 11 deaths from enteric in 1885.

During the year under review 11,908 men of the Bengal Army, or 28·85 per cent. of strength, were located in the Hills. Among the men in the regular Hill Stations sickness was not so frequent as in the previous year; but there were more severe cases, as is shown by the raised daily sick and death-rates, which were respectively 65 and 10·27, against 61 and 9·50 in 1885. The increase of mortality was in hepatitis, circulatory diseases, alcoholism, enteric fever, and dysentery, in the order named.

The health statistics of the troops of the Rajputana, Malwa, Sind, and Aden group were less favourable than in the previous year, the admission and daily sick-rates (1,637 and 80 per 1,000) being considerably higher, with a death-rate (14·94) practically unchanged. Though the death-rate remained below the average of 1870-79, the admission and daily sick-rates both rose above the average for that period. Among the diseases causing increased admission were enteric fever, remittent and simple continued fevers, dysentery, diarrhœa, rheumatism, and venereal diseases. The chief diseases causing increased mortality were enteric fever (5·83 against 3·19 in 1885), and hepatitis (1·09 against 0·20). The largest stations in this group are Mhow (strength 1,329) Kurrachee (860), and Aden (848). Mhow recorded an admission-rate of 1,719 and a death-rate of 12·04, Kurrachee an admission-rate of 1,512, and a death-rate of 20·93, and Aden an admission-rate of 1,143 and a death-rate of 12·97. At Mhow only were the ratios less favourable than those of the previous year. The increased sickness at Mhow was due to fevers, rheumatism, diarrhœa, venereal diseases, and eye diseases; and 50 per cent. of the deaths were from enteric fever against 23 per cent. in 1885, *i.e.*, 8 deaths out of 16 in 1886 against 3 out of 13 in 1885. At Aden, as in the previous year, there were no deaths from enteric fever.

The troops in the Deccan and Nagpur were less healthy than in the previous year, but the admission and death-ratios (1,279 and 10·52) remained below those of the decennial period. Increase of sickness took place chiefly under the heads of enteric and other fevers, diarrhœa, respiratory diseases, and venereal diseases; and of mortality under the heads of enteric fever, hepatitis, dysentery, circulatory diseases, and phthisis. Secunderabad, the largest military cantonment in India, with an average strength of 2,704, and Poona with an average strength of 1,531, are included in this group. At Secunderabad the admission and death-rates were respectively 1,191 and 15·90, both higher than in 1885, while at Poona they were 1,267 and 10·45, both lower than in 1885. The increase of sickness at Secunderabad was chiefly from fevers and diarrhœa, while the number of deaths from enteric fever rose from 10 in 26, or 38 per cent. to 25 in 43, or 58 per cent.

As compared with those of the preceding year, the statistics of the Southern India group were unfavourable, both the admission and death-rates (1,311 and 10·68) being very considerably increased. The admission-rate was also above the decennial average. The greatest increase of admission was in remittent and simple continued fevers and venereal diseases, and the greatest increase of mortality in enteric fever, dysentery, and hepatitis. The largest stations of this group are Bangalore, Bellary, Cannanore, and Madras. At Bangalore, with an average strength of 1,593, the admission-rate was 950, and the death-rate 7·53; at Bellary, with a strength of 820, the admission-rate was 1,309, and the death-rate 3·66. Of these ratios only the death-rate of Bangalore was higher than in the previous year. The number of deaths at Bangalore increased from 4 to 12, the number of deaths from enteric fever from 1 to 8.

The health statistics of the Burma and Pegu group were very unfavourable, as compared with those of the previous year, from the influence of the military operations in Upper Burma. The admission-rate rose from 1,215 to 1,905, the daily sick-rate from 56 to 109, and the death-rate from 12·52 to 34·73. All these ratios of 1886 were also much above the decennial average. The increase in the admission-ratio

was chiefly due to ague, dysentery, and diarrhœa; and the increase in the death-ratio to remittent fever and dysentery. The death-rate for each of these diseases was 0·48 in 1885, and in 1886 rose to 4·71 for remittent fever, and to 6·48 for dysentery. There were 4 deaths from enteric fever against 2 in the previous year, 2 at Rangoon and 2 at Thayetmyo. The other two stations in the group are Toungoo and Port Blair. The highest admission-ratio was 3,005 at Thayetmyo (out of which 1,376 were due to fevers), and the highest death-rate 56·27 at Thayetmyo (22 deaths, of which 5 from hepatitis, 5 from bowel diseases, and 5 from fevers).

The average strength of the men located in the Hill Stations of Madras and Bombay was 681, against 584 in 1885. The admission-rate (1,800 per 1,000) was greater than that of the previous year, and than the decennial average, but the death-rate (14·68) was lower than both. The increase of the admission-rate was due chiefly to fevers. Out of 10 deaths, 4 were from hepatitis, and 2 from enteric fever.

Cholera.

Throughout the Army of India but 41 cases of cholera were treated, or a proportion of 0·7 per 1,000 of strength. Of this number 30 died, or 73·17 per cent. of those attacked. The prevalence of the disease among the European troops was much less than in any of the preceding three years, but the percentage of deaths to cases treated was higher. The average admission-rate for the decennial period 1870–79 was 4·7, and the average percentage of deaths to seizures 69·11 per cent. Of the total (41) number of cases of cholera treated, 36 occurred in the Bengal Army, giving an admission-rate of 0·9 per 1,000 in that Army, against a decennial average of 5·9. The fatality was 69·44 per cent. of seizures against the decennial average of 70·26. Of the 36 cases, 12 occurred at Dinapore, and 8 at Shahjahanpur. Again, of the 36 cases, only 1 occurred before July, and 15 occurred in November. There was no cholera in Southern Afghanistan after its transfer to the Bengal Command on the 1st of April. Only one case occurred in the Madras Army, yielding a ratio of 0·1 per 1,000 against the decennial average of 2·9. The case proved fatal. It occurred among troops on the march. In the Bombay Army only four cases occurred, giving a ratio of 0·4 per 1,000, against a decennial average of 2·1. All the cases proved fatal, a fatality of 100 per cent., against the decennial average of 73·27. Only one case occurred in Southern Afghanistan in the first three months of the year, and it has already been mentioned that none occurred in the last nine months. This is in strong contrast to the state of matters in 1885, in which year there were 117 cases and 71 deaths. Of the other 3 cases in the Bombay Army, 2 occurred at the Deolali Depôt, and 1 at Indore.

Among the troops of the several geographical groups of the Bengal Army there was no cholera in the Hill Stations; there was only one case in the Punjab; and there were only two cases in Bengal Proper, and four cases in Agra and Central India. It was most prevalent in the Gangetic Provinces with 19 cases, of which 12 occurred at Dinapore, and in Meerut and Rohilkhand with 9 cases, of which 8 occurred at Shahjahanpur. The Meerut and Rohilkhand group was the only one which recorded a higher admission-rate than in the previous year, and in the same group the percentage of deaths to seizures was 88·89, against 75·00 in 1885. The admission-ratios of all the groups were lower than the average of either of the decennial periods. In the Gangetic Provinces group, which, as usual, had the highest cholera-ratio, the fatality percentage was 57·89 against 63·96, the average of the decennium 1870–79. In the Meerut and Rohilkhand group the fatality percentage was 88·89, against a decennial average of 68·91.

Small-pox.

In 1886 only 22 cases (0·4 per 1000) of small-pox occurred, with one death; but in the previous year there were no deaths, and only 12 admissions (0·2 per 1,000). The decennial ratio of admissions was 0·7, and of deaths 0·10.

Fevers.

The admission-rate for ague for the whole army of India fell from 471 in the preceding year to 332, a difference of 139 per 1,000, but about 65 per 1,000 of this is due to the exclusion of febricula, which in former years was included in the ague-ratio. There was a diminution of ague in the Bengal and Bombay Presidencies, and an increase in the Madras Presidency. The chief increase of the Madras Presidency occured, as was to be expected, in Burma.

The rise of the admission-rate for remittent and simple continued fever in the army of India from 48 per 1,000 in 1885 to 113 in 1886 is mostly due to the inclusion of febricula for the first time. Including febricula in both years, and comparing 1886 with 1885, we find that the admission-rate was diminished in the Bengal and Bombay Presidencies, and increased in the Madras Presidency, and that the death-rate was

increased in the Bengal and Madras Presidencies. The unfavourable statistics of Madras were in part due to Burma.

Enteric fever.

In recent annual reports the statistical indication has been shown to be that the disease returned as enteric fever is no new disease to India, that the only change has been a change of diagnosis. The determination of the exact nature and nomenclature of the disease must be left to the clinician, the anatomist, and the bacteriologist. But it may not be amiss here to shortly set forth the various diagnostic views which may be gathered from the reports of medical officers. The principal of such views are as follows:—

1.—With regard to frequency and causation—

a. Enteric fever is the principal fever of India, with ague and simple continued; and some of the cases returned as simple continued or ague are in reality mild cases of enteric.

b. There are separate diseases called enteric fever, remittent fever, simple continued fever, and ague, the differential diagnosis of which is, or will be, possible through patience, perseverance, and increasing knowledge.

c. There are cases which can easily be recognised respectively as enteric, remittent, simple, and ague; but the difficulty of diagnosis, when it exists, corresponds to the reality that these affections shade off into each other, being due to one *causa causans* influenced by different circumstances.

d. There is little or no enteric fever in India, meaning thereby the disease so called in Europe, but fever with catarrhal follicular inflammation and ulceration of the intestines is common, *an* enteric fever, but not "enteric fever."

2.—With regard to nature and causation—

a. The disease and its causation are the same as in England, in spite of irregularities in course and appearances, and of difficulty in catching the cause *in flagrante delicto*.

b. The disease is enteric fever but distorted by the intercurrence of malaria.

c. The disease is a hybrid of enteric and malarial fever.

d. The disease is purely malarial. Of those who hold this view some believe that the European disease is also malarial, and that the Indian and European diseases are, therefore, practically identical; others that the Indian disease differs from the European in being malarial, while the European is pythogenic; others that Indian enteric fever is nearly related to dysentery.

3.—With regard to causation—

a. The disease is due to climatic or telluric influences acting on young and unacclimatised men.

b. The disease is due to local insanitary conditions acting on young and unacclimatised men.

Those who hold the former view say that the sanitation of the soldiers' immediate surroundings is perfect, or at any rate more perfect than in Europe. They ask why the women and children are so little affected—

Period.	Men.		Women.		Children.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
1870–79 - -	4·6	2·03	1·6	0·83	0·9	0·23
1880–85 - -	8·4	2·90	3·1	0·98	1·0	0·15
1886 - - -	18·1	5·08	5·6	2·36	2·1	0·46

in comparison with the men, if the disease is due to local insanitary conditions; and they point out that there is a decided coincidence of rise and fall of enteric with the rise and fall of the acknowledged malarial diseases.

Those who believe in the pythogenic origin of the disease reply that, no doubt, the sanitary arrangements of the cantonments are most perfect, but that the whole of India is little better than one vast latrine, and an evil-smelling one; and that, as the sanitarily perfect cantonment is surrounded by a vastly greatly area of insanitation, there may be a thousand unsuspected ways in which the enteric cause may be introduced; and also that the soldier has in the villages and bazars many opportunities of ingesting filth, filth-poisons, or bacilli. They say also that the atmospheric and telluric conditions at the time of prevalence of malarial diseases are just such as might be expected to breed filth-diseases.

Whichever of these views may be correct, there is no doubt whatever that it is extremely rare for a medical officer even to think that he has discovered a definite local insanitary condition to which he can with any confidence assign the outbreak of the disease.

With regard to the post-mortem records of fatal cases it is to be regretted that too commonly, instead of a description of the lesions actually present, there is merely a statement that "typical typhoid lesions" or "typical typhoid ulcers" were found. In reading these records one is also struck by the fact that every ulceration of the intestine not diagnosed as dysenteric seems to be at once put down as "enteric," regardless of the fact that even in Europe many different kinds of intestinal ulcers are recognised, and that the "enteric" ulcer is mostly confined within the limits of the follicles or follicular patches, whereas the ordinary and non-specific follicular ulcer tends to overstep those bounds.

Such follicular inflammations and ulcerations are well known to accompany almost all inflammations of the intestinal mucous membrane (*Orth, Rindfleisch, Klebs, Coats, Ziegler, &c.*) from many specific and non-specific causes. One such recognised cause is hot weather (intestinal summer catarrh). Follicular inflammation, when not "enteric" is no doubt most common in the large intestine; but it is just one of the striking differences between the lesions found post-mortem in India and those of Europe that in the former the large intestine is not only often described as affected, but is even not unfrequently described as solely or principally affected. It behoves, therefore, the medical officer to be careful and cautious in his diagnosis of the intestinal lesions, remembering that there is no pathological improbability in follicular ulceration accompanying remittent or any other fever, and that he himself, or his colleagues, has seen follicular dysentery accompanying or following on malarial fever, —a process which at different stages might be differently diagnosed post-mortem. He should even be alive to the possibility of meeting with cases in which the intestinal lesion and the fever do not form one disease, but two independent diseased conditions.

In Indian post-mortem examinations the lesions recorded seem, on the one hand, often too extensive and irregular to be characteristic of enteric fever; while on the other, cases occasionally occur in which, while the symptoms during life had satisfied the medical officers that the disease was enteric fever, absolutely no lesions were found after death which could be called "enteric."

In the following table the admission and death-rates for enteric and other fevers in the three presidencies are contrasted :—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.
1870–79*	5·3	607·3	612·6	2·28	1·74	4·02	3·9	266·5	270·4	1·42	0·62	2·04	3·1	659·9	663·0	1·75	1·14	2·89
1880†	8·7	809·6	818·3	3·07	2·66	5·73	2·6	450·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881†	6·3	763·9	770·2	2·62	0·81	3·43	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8	2·83	0·91	3·74
1882	7·3	600·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	558·5	563·6	1·90	0·81	2·71
1883	8·1	486·4	494·5	2·52	0·44	2·96	8·6	128·4	137·0	2·86	0·28	3·14	5·7	436·4	442·1	1·55	0·73	2·28
1884	12·6	682·8	695·4	3·31	0·36	3·67	11·4	166·0	177·4	1·67	—	1·67	9·1	504·4	513·5	2·05	2·14	4·19
1885	14·0	611·0	625·0	4·05	0·60	4·65	6·4	149·4	155·8	2·19	0·19	2·38	7·3	577·5	584·8	2·54	1·49	4·03
1886	21·6	490·5	512·1	5·70	0·99	6·69	11·9	259·8	271·7	3·85	0·89	4·74	12·3	472·2	484·5	4·16	0·27	4·43

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

In all three presidencies the enteric admission-ratio was higher than in the previous year, and at the same time in all three the percentage of deaths to cases treated fell, showing that mild as well as severe cases are now being diagnosed as enteric. Both enteric and the other fevers were more prevalent in the Bengal Army than in those of Madras and Bombay. The high rate of admission of 1885 for enteric fever in the Bengal Army, 14·0, was suspassed by that of the year under review, namely, 21·6 per 1,000, the decennial average being 5·3. The admission-rate for other fevers fell from 611 to 490·5, the decennial average being 607. The next highest admission-rate for enteric fever was recorded in the Bombay Army, 12·3; but Madras was close

behind with a ratio of 11·9, both being much above the respective decennial averages of 3·1 and 3·9. For the other fevers the Madras ratio alone was higher than that of the previous year, but the ratios of both Bombay and Madras were considerably below the decennial averages. The change of diagnosis is at the root of most of the above-cited facts. Looking next to the total admission and death-rates in the three armies for both enteric and the other fevers together, it will be observed that only in the Madras Army does the combined admission-ratio of the year under report come up to the decennial average, while in all three the combined total death-rate is over the decennial average, and also over the combined total of the previous year. In Bengal the increase over the previous year was 2·01, of which enteric contributed 1·65, and the other fevers 0·36; in Madras the increase was 2·36, of which enteric contributed 1·66, and the other fevers 0·70; in Bombay the increase was 0·40, which was made so small by the increase of 1·62 in enteric being counterbalanced by a decrease of 1·22 in the other fevers, the 1886 mortality from these fevers being smaller than any previously recorded. In Bengal and Madras the increased combined mortality is almost proportional to the increase of the enteric fever admission-rate; while in Bombay this is not so, on account of the great reduction in the other fevers, but the enteric death-increase is nearly proportional to the enteric admission-increase. The difference in these cases shows that the enteric admission-ratio has increased more rapidly than the enteric death-ratio.

The following table is introduced to show the fluctuations in the death-rates from enteric and the other fevers during the years 1872–86:—

Presidencies.	Fevers.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.	1883.	1884.	1885.	1886.
Bengal	Intermittent, remittent, and simple continued.	1·78	1·39	1·10	1·18	0·71	0·66	1·56	2·63*	2·66*	0·81	0·77	0·44	0·36	0·60	0·99
	Enteric - - -	1·62	1·53	2·01	1·59	1·75	1·55	4·69	3·86*	3·07*	2·62	2·90	2·52	3·31	4·05	5·70
	Total -	3·40	2·92	3·11	2·77	2·46	2·21	6·25	6·49*	5·73*	3·43	3·67	2·96	3·67	4·65	6·69
Madras	Intermittent, remittent, and simple continued.	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27	0·28	—	0·19	0·89
	Enteric - - -	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86	1·67	2·19	3·85
	Total -	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14	1·67	2·38	4·74
Bombay	Intermittent, remittent, and simple continued.	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81	0·73	2·14	1·49	0·27
	Enteric - - -	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83	1·90	1·55	2·05	2·54	4·16
	Total -	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·71	2·28	4·19	4·03	4·43

* Excluding troops in Afghanistan.

The approximate total average for Bengal for the 15 years was 4·03, which was exceeded in the years 1878, 1879, 1880, 1885, and 1886. In Madras the average of 2·18 was exceeded in nine years out of the 15, including 1886. In seven out of the 15 years, including 1886, the average of 3·44 was exceeded in Bombay. The main results of the foregoing table are brought together in the following table for facility of comparison:—

	During 1870–79.			During 1880–85.			During 1886.		
	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.
Army of India -	2·03	1·42	3·45	2·89	1·02	3·91	5·08	0·84	5·92
„ Bengal -	2·28	1·74	4·02	3·18	1·08	4·26	5·70	0·99	6·69
„ Madras -	1·42	0·62	2·04	1·79	0·22	2·01	3·85	0·89	4·74
„ Bombay -	1·75	1·14	2·89	2·77	1·55	4·32	4·16	0·27	4·43

* Intermittent, remittent, and simple continued fevers.

This table and its predecessors show that, while enteric fever has gone on increasing, the other fevers have gone on decreasing; that the last two years, and especially 1886, have been fever years; that the total fever mortality is much the same in 1886 as in previous fever years, though naturally higher than in non-fever years; and that from the influence of the military operations in Burma, as already mentioned, Madras in 1886 has an increase in the mortality from the other fevers, as well as in that from enteric.

The relationship between enteric fever and age is exhibited in the following table:—

Year	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	1·04	9·1
1879	6·17	54·1	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14
1883	4·34	66·36	1·50	22·94	0·70	10·70
1884	4·61	62·05	1·83	24·63	—	—
1885	5·16	61·06	2·30	27·22	0·74	8·76
1886	7·44	63·05	3·08	26·10	1·02	8·65

The results given do not differ materially from those of recent years, and their significance has not only been repeatedly indicated in former annual reports, but is also well known to all medical officers of Indian experience.

As with age, so with length of service in India, the disease stands in well-defined relationship. With increased service in India liability to become affected by enteric fever rapidly diminishes. A comparison of the following tables with the foregoing supports also the opinion, expressed by many medical officers as the result of experience, that shortness of Indian service is even more powerful than unripeness of age as a predisposing cause of enteric fever:—

Statement showing the proportion of men who have served in India two, five, and seven years from 1871–86.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1879	32·1	60·9	72·6
1872	33·7	66·7	80·0	1880	33·4	65·4	77·2
1873	31·7	65·5	79·6	1881	38·9	70·4	81·1
1874	25·9	64·3	79·8	1882	33·1	71·9	82·9
1875	26·1	60·1	81·0	1883	32·3	74·7	85·5
1876	25·5	57·6	75·1	1884	36·2	75·0	86·2
1877	25·2	56·2	72·6	1885	36·6	73·0	86·8
1878	28·9	59·8	73·0	1886	3·88	74·7	86·8

Statement showing the death-ratios of the European Army from Enteric Fever at different periods of residence in India, together with Ratios of Liability to it, for 1877–86.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at Different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability
1877	3·31	59·5	1·35	24·2	0·90	16·1
1878	7·90	63·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·08	75·98	1·78	14·90	0·47	3·93
1881	4·55	60·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44
1883	4·98	70·34	1·55	21·89	0·55	7·77
1884	5·47	70·04	1·55	19·85	0·46	5·89
1885	6·55	68·87	1·93	20·29	0·38	4·00
1886	8·63	64·12	3·31	24·59	1·12	8·52

As in former years, so in 1886, medical officers were unable to trace the causation of the disease, to point out in any given outbreak a definite insanitary condition to which the outbreak might with certainty, or even with plausibility, be attributed. Conservancy and water-supply were mostly pronounced perfect, and in some cases the water had been specially analysed and found good. Some of the causes suspected by medical officers, or assigned by patients, were chill while heated, drinking marsh water while out shooting, drinking liquids of unknown quality as to purity in the villages and bazars. Scurvy is mentioned as predisposing to the disease and aggravating it. With regard to very many of the admissions for enteric fever in the hills it is stated that the disease must have been, or probably was, contracted in the plains just before the transfer of the men to the hills.

As in this place of the report of the previous year the statistics of Quetta were given, so it may be as well to give them for 1886 also here. The following table shows that ague still goes on increasing, that there was in 1886 an increase also of simple continued and remittent fevers, not accompanied by any increase of mortality; and that there was a considerable lowering of the admission ratio for enteric fever, with, however, an increase of one per 1,000 in its death-ratio:—

	*1882.		*1883.		1884.		1885.		1886.	
	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.
Enteric fever - - -	12·9	3·23	11·6	4·83	29·6	9·27	9·5	2·71	5·6	3·77
Intermittent fever - -	265·9	—	252·4	—	484·7	—	1,277·4	—	1,602·6	—
Remittent and continued fevers-	74·3	—	18·4	—	282·7	5·56	62·9	4·74	89·1	4·39
Total - - -	353·1	3·23	282·4	4·83	797·0	14·83	1,349·8	7·45	1,697·3	8·16

* Including Gulistan for a short period.

Speaking of ague in the Quetta District, Surgeon Kelly says:—

"It is difficult to account for these cases on the generally accepted theory that ague is produced by the action of a poison originating in the ground, and the result of vegetable decomposition. Here there is practically no vegetation, and the water is absolutely pure. I think it possible that all the phenomena of ague may be the result of the inability of the ordinary regulators of the body temperature to cope with the great variations in atmospheric temperature so marked here and in the Quetta District generally. * * * At any rate, there can be no doubt that the variations of temperature play an important part in producing the disease."

Bowel-complaints.

Both dysentery and diarrhœa were more prevalent in the army as a whole than during the previous year, but in the case of each the death-rate (1·20 and 0·07 respectively), was lower than the decennial average. The severity of the cases of dysentery treated were greater than in the previous year, the percentage of deaths to cases treated being 3·46 against 2·80. The decennial percentage was 3·65; the percentage in diarrhœa was 0·12 against 0·10. The decennial percentage was 0·19. Dysentery was most prevalent, as usual, in the Madras Army. That the mortality from dysentery was highest also in the Madras Army, that the percentage of deaths to cases was highest in the Madras Army, and that the mortality in the Bengal Army was higher than usual of late years, were facts all due to the influence of the military operations in Upper Burma. The greatly reduced prevalence and mortality from dysentery in the Bombay Presidency were due to the exclusion of Southern Afghanistan from the Bombay Command, and the extraordinary coincident improvement in the health of Southern Afghanistan prevented its transfer to the Bengal Command from injuriously affecting the statistics of the Bengal Army. Diarrhœa was most prevalent and most fatal in Madras. It caused no deaths in the other Presidencies.

Heat-stroke.

Under the heading "Apoplexy and Heat-stroke," by far the greater number of cases and deaths is due to the latter. Their admission-rate was 4 per 1,000 against 3 in the preceding year, and their death-rate 0·88 against 0·86.

Hepatitis.

In the army as a whole the admission-rate from hepatitis (23 per 1,000), remained unchanged, as compared with that of the previous year, while the death-rate was

increased (1·47 against 0·88). The same was the case in the Bengal Presidency. In the Bombay Presidency the admission-rate was diminished, the death-rate increased. While in the Madras Presidency alone were both admission and death-rates increased, the former by 3 per 1,000 the latter by 1·46. The average mortality caused by this disease in the army in the period 1870-79 was nearly 1½ times as great as that of the year under review, 2·19 against 1·47 per 1,000. This fall in mortality is observable in all three presidencies, the difference being 0·78 in Bengal, 0·66 in Madras, and 0·53 in Bombay. At the same time the mortality from hepatitis in each presidency was considerably greater than in 1885.

Respiratory diseases.

It is very satisfactory again to observe a marked fall in the admission-rate (60 per 1,000 against 65 in 1885) for respiratory diseases in the Army of India as a whole. The death-rate was also reduced from 0·88 to 0·62. With the exception of the Bengal death-rate (0·75), which was slightly increased, the admission and death-rates for all three Presidencies were below those of the preceding year. The diminution of both admission and death-rates was most marked in the Bombay Presidency (62 and 0·45 per 1,000 against 67 and 1·93 in 1885); and here, though still somewhat above the others in the admission-rate, was no longer the highest in mortality. The Madras death-rate (0·36) was slightly above the decennial average, but all the other admission and death-ratios were well below their decennial averages.

Venereal disease.

The progressive increase in the admission-rate from venereal diseases continued in 1886. This increase was shared by all three presidencies, but was most marked in Bombay.

Admissions from Venereal Diseases in the three Presidencies.

Presidency.	Admissions per 1,000.								
	1860–69.	1870–79.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Bengal	265	209	276*	276*	271	281	291	363	394
Madras	†	198	275	258	288	289	307	350	394
Bombay	†	191	269	261*	224	218	292	272	370
India	†	203	250	260	265	270	294	343	389

* Excluding troops in Afghanistan.
† The statistics of Madras and Bombay, and for the whole of India for these years are not available.

Syphilis, both primary and secondary, and gonorrhœa, with other venereal diseases, all gave rise to a higher proportion of admissions than during the preceding year. Secondary syphilis gave rise to an admission-rate of 33·3 per 1,000, or 4·6 more than in 1885. Up to 1884, and since 1876, the ratios of admission for this form of venereal disease remained remarkably constant, varying from 22 to 25 per 1,000, while the admission rates for primary syphilis fluctuated between 60 and 95. In 1886 ulcer of the penis has been added to primary syphilis to make that year comparable with former years, in which under the old nomenclature soft sores were returned as primary syphilis.

The Bengal Army had the largest proportion of admissions from primary syphilis, the Madras the highest from secondary syphilis and from the other venereal diseases; but all three presidencies were very close together in their secondary syphilis ratios, the order being Madras, Bombay, Bengal. Madras took the second place with regard to primary syphilis, and Bombay the second place with regard to gonorrhœa with other venereal diseases. In the following table the admission-ratios for venereal diseases in the three armies of India are compared with those of 1872:—

Admission Rates from Primary and Secondary Syphilis and Gonorrhœa and other Venereal diseases for 1886 *compared with Rates of* 1872.

	Primary Syphilis.			Secondary Syphilis.			Gonorrhœa and other Venereal Diseases.		
	1886.	1872.	Difference.	1886.	1872.	Difference.	1886.	1872.	Difference
Bengal Army	168·0	61·9	+106·1	33·1	22·6	+10·5	185·7	98·5	+87·2
Madras „	143·8	65·4	+78·4	33·7	29·2	+4·5	215·7	68·8	+146·9
Bombay „	135·7	54·4	+81·3	33·5	14·0	+19·5	205·2	82·4	+122·8

It will be seen that the results of 1886 are in all cases less favourable, and generally very considerably less favourable, than those of 1872.

Throughout the Army of India 1,303 men were invalided, or 21·10 per 1,000 of strength. This ratio is below those of the five preceding years, and 21·94 below the decennial average of 1870–79, namely 43·04. It is the lowest ratio on record, at least from 1870 onwards, the next lowest having been 22·81 in 1885 and 26·31 in 1880. The proportion of invalids to strength contributed by the Bombay Presidency is highest, and that contributed by the Bengal Presidency, as usual, lowest. Invaliding.

Forty-one per cent. of the total number invalided from the Army of India were discharged as unfit for further service. This proportion, as may be seen in the following table, was much the same as in the immediately preceding years, but higher than in the earlier years given in the table. Only in Bengal was the proportion of discharge greater than in the previous year, the chief causes being valve disease of the heart, phthisis, epilepsy, ear-diseases, and syphilis; and it was greater than in either of the other two presidencies, Madras coming next.

Percentage of those invalided for discharge to total number invalided.

—	1881.	1882.	1883.	1884.	1885.	1886.
Army of India -	35	37	39	41	40	41
„ Bengal -	43	40	45	45	43	46
„ Madras -	32	38	40	36	47	42
„ Bombay -	17	26	21	33	29	28

In each Presidency the chief causes of invaliding were anæmia and debility and circulatory diseases, and in Madras also hepatitis. After these came phthisis in Bengal and Bombay, and dysentery and then phthisis in Madras.

The invaliding from mental disease in the Army of India was less than in the previous year (56 against 75), each presidency sharing in the reduction, but especially Bombay, where there were no cases of mania, against seven in the previous year. Melancholia was the prevailing form of alienation in Bengal, and dementia in Madras.

In regard to invaliding with reference to age, the percentage of those under 25 years to the whole number invalided was 43·92 for the Army of India. This is higher than the percentages of the preceding three years, which were themselves unusually high. The percentage between 25 and 29 was somewhat lower than in the previous year, and that above 30 much the same, and therefore low. There has been of late years an increase of the percentage of men under 25 in the strength of the army, and a decrease in the percentage of those over 30. This also is one reason why the ratio per 1,000 of men under 25 invalided has fallen as compared with 1871–75 or 1871–79.

Next, as regards the influence of length of service in India upon invaliding, the following table shows that a residence of from two to five years is the time during which the largest proportion of men break down.

Number of men under two years, and between 2 and 5 years', service Invalided per cent. of total number Invalided.

Service.	1886.	1885.	1884.	1883.	1882.
Under 2 years -	24·31	22·56	24·19	18·94	17·35
2 to 5 years - -	49·85	54·64	49·97	57·81	57·30

In 1886 the percentage of men under two years' service to the whole number invalided was increased, the percentage between two and five years decreased, the result being that the figures for 1886 are very close to those for 1884. That 74 per cent. of the invaliding should be among men of not more than five years' Indian service appears natural, when it is seen from the next table that 75 per cent. of the European soldiers in India are of not more than five years' Indian service.

Table showing Percentages of men up to 5 years' residence in the Army of India, and Percentages of those men Invalided to total Invalided.

Residence.	1886.	1885.	1884.	1883.	1882.	1881.	1880.
0 to 5 years' residence - -	75	73	75	75	72	70	65
Invalided - - - -	74·16	77·20	74·16	76·75	74·65	71·75	67·66

The ratio per 1,000 of invalids to men of not more than five years' service was 37·50 in 1886, against the approximate average 56·86 in the preceding six years; the reason being again the high proportion of men of short service in the army. If the year 1886 be compared with the period 1871–79, it will be found that the percentages of invaliding due to phthisis and to bowel diseases remained the same, that those due to anæmia and to hepatitis were much diminished, and that those due to venereal diseases and circulatory diseases were increased; while the ratios of all per 1,000 of strength were diminished. The percentage of invaliding in the first four years of service has risen from 48 in the period 1871–75 to 68 in the period 1881–85, and 67 in the year 1886; while the percentage of men in the first four years of service who were under 30 years of age has risen from 73 in 1871–75 to 93 in 1886. Finally, it may be surmised that the very low invaliding rates of 1885 and 1886 are connected in some way with the military operations in Burma, though the means of discerning the connexion are not at present available.

The following table can no longer be expected to exhibit the striking contrasts of former years, because the whole army is now practically a young army and an army of short service:—

Experience of newly arrived Regiments in 1886 (*during the* 1*st year of Indian residence*).

—	Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily Sick-rate.	Death-rate.	Deaths from				
					Enteric Fever.	Other Fevers.	Apoplexy and Heat-stroke.	Dysentery and Diarrhœa.	Hepatitis.
Army generally -	61,015	1513·9	74·7	15·18	5·08	0·86	0·88	1·27	1·47
New regiments -	1,922	1309·6	61·8	13·53	6·76	—	—	0·52	1·04

But the mortality from enteric fever is still markedly higher in the newest regiments.

Sickness and mortality among women and children.

In 1886 there was a slight decrease in the numbers of women and children in the European Army of India. In the case of the women the death-rate of 15·92 of an average strength of 3,391, though about 3 per 1,000 higher than that of the previous year, compares favourably with the rates of former years, and also with the death-rate of the period 1870–79, which was 25·09 per 1,000. Eleven deaths each were caused by child-birth and abortion, and by phthisis pulmonalis—a ratio for each of 3·25 per 1,000 of strength. The proportion of deaths caused by child-birth and abortion is usually greater than that due to any other class of disease, and in 1886 the proportion was higher than in 1885, and than in the ten-year period, the ratios for which were respectively 2·63 and 2·93. The high proportion of deaths from phthisis in 1886 was unusual. There was only one death from phthisis in 1885. The next most frequent causes of death in 1886 were enteric fever (2·36), anæmia and debility (1·18), and apoplexy and heat-stroke (1·18). The proportion of deaths returned as due to enteric fever was much higher than in 1886, and very much higher than in the period 1870–79, the ratios for which were respectively 1·47 and 0·83. But it is curious to observe in comparing 1886 with the period 1870–79 that the ratio of deaths from remittent and continued fevers has sunk in the same proportion as the ratio of deaths from enteric has risen. The proportion of deaths from bowel diseases was

less than in 1885, while that from respiratory diseases was unchanged. The death-rates in the three presidencies were—Bengal 17·98, Madras 12·32, Bombay 14·83, against 13·34, 13·25, and 10·95 in 1885. The increased mortality in Bengal was chiefly under the heads of enteric fever, phthisis, puerperal affections, anæmia and debility, apoplexy, and heat-stroke; that in Bombay under the heads of respiratory diseases, phthisis, remittent and simple continued fevers, apoplexy and heat-stroke, anæmia and debility. In Madras the largest proportion of deaths was due to puerperal affections and to phthisis.

The average number of children in the Army of India was 6,552, against 6,632 in the previous year; the number of deaths 298 against 307; the death-rate 45·48 against 46·29 in 1885 and 68·96 in the ten-year period 1870–79. Convulsions and diarrhœa were the most frequent causes of death, with a ratio each of 8·09 against 10·25 and 10·40 respectively in 1885. Next came, at a considerable interval, anæmia and debility, teething, bronchitis and pneumonia, remittent and simple continued fevers. The distribution of the total mortality among children for the Army of India in the three presidencies was as follows:—Bengal 44·46 against 53·54 in 1885; Madras 45·35 against 29·54; Bombay 48·74 against 50·77. The increase in Madras was under the heads of diarrhœa, teething, and convulsions, malarial and sun fevers, tubercular diseases, respiratory diseases, anæmia and debility. There was no cholera among the children in 1886. As in the previous year, Madras had a much higher ratio of admissions for respiratory diseases than the other presidencies.

Native Troops.*

Sickness and mortality in 1866.

The health of the Native Army of India as a whole was favourable in 1886. All the rates were lower than those of the quinquennial period 1877–81, and, excluding the absent deaths, lower than those of 1885. The cholera mortality was less than in the previous year, and its maximum was in Bengal Proper instead of in Southern Afghanistan. Though lower than that of 1885, and than the average of the quinquennium, it was higher than that of any of the other years between 1879 and 1885. The total mortality ratio, 13·27 per 1,000, was less than that of the European Army (15·18), and was nearly 2½ times less than that of the Jails of India (31·85).

Sickness and Mortality during the years 1877 *to* 1886 *compared.*

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81 -	118,669	1,422	48	1·94	24·90	27·40
1877 - -	113,966	1,030	32	1·53	10·90	13·38
1878 - -	117,273	1,460	43	2·06	18·04	21·02
1879 - -	121,107	1,735	58	4·61	35·15	37·79
1880 - -	126,385	1,545	56	0·53	39·22	41·12
1881 - -	114,612	1,305	46	0·97	19·24	22·62
1882 - -	114,894	1,129	37	1·02	12·24	14·76
1883 - -	114,830	923	31	1·15	11·76	14·31
1884 - -	114,827	1,042	33	0·71	10·50	12·22
1885† - -	115,486	978	32	1·61	13·67	16·09
1886† - -	106,010	973	31	1·27	13·27	19·46

† Excluding men on active service in Burma.

Malarial and simple fevers were, as usual, the most frequent causes of admission into hospital, giving rise to a ratio of 429 against 431 per 1,000 in 1885. The details of this ratio are ague 389, remittent 10, simple continued 30. It differs from the

* Excluding troops on active service in Burma, the returns for which are not complete.

corresponding ratio for the European Army in its higher proportion of ague and its lower proportion of simple (or heat) fever. Of the other chief causes of admission the only ones which gave rise to higher ratios than in the preceeding year were diarrhœa, abscess and ulcer, and guinea-worm. The admission-ratios for enteric fever, hepatitis and phthisis were the same as in 1885. The cholera admission-rate was higher than in any of the six preceeding years except 1885. That of enteric fever in 1880 was 0·3 per 1,000 of strength, and has ever since that remained year by year at 0·2 per 1,000; while the mortality has varied between 0·04 and 0·12 per 1,000 of strength, and the fatality between 27·78 per cent. of deaths among those attacked in 1883 and 1886 and 61·11 among those attacked in 1884. Malarial fevers were less prevalent than in any of the six preceding years except 1883. Bowel diseases were less prevalent than in any of those six years except 1883 and 1882, and dysentery than in any except 1883. Respiratory diseases were less prevalent than in any of the same six years except 1883 and 1884. The chief cause of mortality in the Native Army was, as usual, respiratory disease, which in 1886 caused 3·68 deaths per 1,000 of strength against 3·74 in 1885, and was answerable for nearly 28 per cent. of the total mortality. This ratio of deaths to strength is lower than that of any of the preceding six years except 1884. Next to respiratory diseases remittent fever contributed most largely to mortality (1·37), and next in order cholera (1·27), anæmia and debility (0·88), dysentery (0·74), phthisis (0·69), and diarrhœa (0·65).

Bengal Army.

Though the admission-rate in the Bengal Army was lower than the decennial average, and lower than the rate of any single year quoted in the following table except 1883, and though the daily sick-rate was not increased, and was not high, yet the death-rate was increased by 4·34 per 1,000. This increased mortality, which showed itself chiefly under the heads of cholera, diarrhœa, dysentery, fevers, respiratory diseases, wounds, and debility, was owing to the transfer of unhealthy Southern Afghanistan to the Bengal Command, to the unhealthiness of Tammu and the Eastern frontier, and probably also to the indirect influence of the military operations in Burma.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1867–76 - - - -	39,508	1,360	42	2·12	13·84	17·25
1877 - - - -	39,649	1,097	34	0·35	10·32	13·63
1878 - - - -	41,116	1,645	49	2·09	22·59	25·57
1879* - - - -	31,116	2,023	68	2·80	31·78	53·61†
1880* - - - -	30,365	1,609	65	1·52	33·85	53·15†
1881* - - - -	36,896	1,495	51	0·92	19·76	27·73†
1882 - - - -	40,256	1,250	41	0·72	13·34	16·49
1883 - - - -	40,932	985	32	0·56	10·55	13·98
1884 - - - -	40,850	1,193	35	0·71	10·97	12·56
1885‡ - - - -	40,753	1,076	34	0·29	10·11	14·18
1886§ - - - -	40,547	1,065	34	1·87	14·45	22·29

* Excluding troops in Afghanistan.

† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

‡ Excluding men on active service in Burma and Egypt.

§ Excluding men on active service in Burma.

Among the chief diseases which caused increased admission rates as compared with 1885 were cholera, bowel diseases and respiratory diseases; among those that caused decreased rates were ague, hepatitis, spleen and rheumatism; while scurvy prevailed in the same proportion as in the previous year. The death-ratios from cholera, fevers, bowel diseases, respiratory diseases, debility and injuries were all increased; while the only important diseases from which there was diminished mortality were phthisis and scurvy. The highest proportion of mortality was caused by respiratory diseases, as usual; but the ratio was 3·28 against 2·77 in 1885 and 1884. Of cholera, 116 cases were treated, of which 76 or 65·52 per cent. terminated fatally.

The proportions in which the various geographical sections of the army of Bengal contributed to the general admission and death-rate are shown in the following table :—

Year.	Ratio per 1,000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkhand and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76 -	1,523	19·13	1,062	8·38	987	11·19	1,588	9·61	1,459	14·24
1877 -	1,492	19·64	768	5·19	642	9·52	906	7·41	1,243	8·85
1878 -	1,527	22·13	1,036	7·88	1,008	9·83	1,581	12·96	1,896	18·53
1879 -	1,816	25·57	1,658	11·05	2,038	36·17	2,303	16·07	2,173	47·64
1880 -	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881 -	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	22·86
1882 -	1,569	18·22	1,081	10·01	1,083	9·98	1,248	7·18	1,268	13·30
1883 -	1,408	16·23	970	8·17	978	11·53	906	5·77	830	10·80
1884 -	1,367	14·61	929	6·00	1,188	10·62	1,312	7·84	1,083	8·49
1885 -	1,278	9·96	990	6·42	1,179	10·04	1,333	8·28	902	9·92
1886 -	1,692	38·45	896	5·35	1,349	13·64	1,386	6·90	779	8·61

Both in sickness and in mortality Bengal Proper and Assam rose from the second to the first place, leaving the remaining groups otherwise in the same relative positions as in 1885. This evil pre-eminence of Bengal Proper and Assam was chiefly due to the prevalence of cholera and bowel diseases among the troops in and about Tammu, on the Eastern frontier. In the Bengal and Assam, and in the Rohilkhand and Meerut groups, both the admission and the death-rates were above those of 1885, and were also above the averages of 1867–76. The table shows that only twice since 1876 has the admission-rate of Rohilkhand and Meerut been under the average of 1867–76; but it also shows that that average was lower in the case of Meerut and Rohilkhand than in that of any of the other groups. With the exception that the admission-rate of Agra and Central India was higher than that of the previous year, the admission and death-ratios of the other groups were all below both the ratios of 1885 and the average ratios of 1867–76. The increased sickness and mortality in Bengal Proper and Assam was due mainly to cholera, bowel diseases and respiratory diseases; the increased sickness in Rohilkhand and Meerut to fevers, respiratory diseases, and bowel diseases, the increased mortality in the same to respiratory diseases, phthisis, and fevers; and the increased sickness in Agra and Central India to diarrhœa, respiratory diseases, rheumatism, abscess and ulcer, and injuries.

The chief causes of sickness in the various geographical groups are set forth in the following table :—

Groups.	Ratio of Admission per 1,000 of Strength.					
	Fevers.*	Bowel Complaints.	Spleen Diseases.	Respiratory Diseases.	Rheumatism and Neuralgia.	Abscess and Ulcer.
Lower Bengal and Assam - -	779	291	10	82	40	89
Gangetic Provinces - -	371	60	6	29	36	110
Rohilkhand and Meerut - -	742	61	7	66	38	107
Agra and Central India - -	677	55	4	51	49	154
Punjab - - - - -	312	38	5	41	30	92

* Ague, remittent, simple, continued, enteric.

Compared with the ratios of 1885, fevers were more prevalent in Lower Bengal and Assam, where the increase was 190 per 1,000, and in Rohilkhand and Meerut, where the increase was 195 per 1,000. Bowel complaints gave rise to higher ratios in Bengal and Assam (increase 155 per 1,000), in Rohilkhand and Meerut (increase 4 per 1,000), and in Agra and Central India (increase 5 per 1,000). There was a diminution of respiratory disease in the Gangetic Provinces and in the Punjab, especially in the former, but an increase in the other three groups.

The chief causes of mortality in the several geographical groups in the Bengal Army are shown in the following table :—

Groups.	Ratio per 1,000 of Strength.				
	Cholera.	Fevers.*	Bowel Complaints.	Respiratory Diseases.	Total, all Causes.
Lower Bengal and Assam - -	10·52	5·36	13·39	1·34	38·45
Gangetic Provinces - -	0·50	0·83	1·01	0·66	5·35
Meerut and Rohilkhand - -	0·57	2·27	0·76	3·98	13·64
Agra and Central India - -	—	1·14	0·58	1·72	6·90
Punjab - - - -	0·05	2·00	0·22	3·14	8·61

* Ague, remittent, simple continued, enteric.

The cholera death-ratio rose slightly in the Gangetic Provinces and in Rohilkhand and Meerut, fell slightly in the Punjab, fell to zero in Agra and Central India, but rose from 0·35 to 10·52 in Lower Bengal and Assam. It has already been mentioned that most of the cases in this last group occurred on the Eastern frontier at and near Tammu. As in the previous year, there was only one case, a fatal one, of cholera in the Punjab. The death-rate from fevers increased in Lower Bengal and Assam, and in Rohilkhand and Meerut. The death-rate from bowel complaints increased in Lower Bengal and Assam, in the Gangetic Provinces, in Rohilkhand and Meerut, and in the Punjab; the death-rate from respiratory diseases increased in Lower Bengal and Assam, and in Rohilkhand and Meerut. The only two groups in which the death-ratios of all the diseases given in the table were higher than in 1885 were Lower Bengal and Assam, and Rohilkhand and Meerut; and the total death-rate from all causes rose in the case of the former from 9·96 to 38·45 on account of the unhealthiness of the troops in Tammu and its neighbourhood. Only in the same two groups also was the total death-rate higher than the average of the decennium 1867–76,—in the case of Bengal and Assam by 19·32 per 1,000, and in that of Rohilkhand and Meerut by 2·45. In the former group all the diseases in the table were higher than their decennial averages, except respiratory diseases; while in the latter only respiratory diseases were above their decennial average, there having been 12 deaths from respiratory diseases at Delhi alone.

Of individual stations, Tammu, which was occupied for 11 months, had an admission-rate of 5,287 per 1,000 and a death-rate of 328·67. Of the stations occupied throughout the year, 10 recorded admission-rates of over 1,500 per 1,000 against 9 in the previous year, the highest ratios having been recorded at Agra, Quetta District, Saugor, Delhi, Shillong and outposts, Dehra Dun, Silchar and outposts, in the order in which they are here named.

Four stations occupied throughout the year by the regular troops of the Bengal Army recorded mortality-ratios exceeding 20 per 1,000, the same number as in the previous year. Those stations are, viz., Quetta District 109·87, Silchar and outposts 77·72, Delhi 34·11, Sipri 33·33.

In the Quetta District the average strength was 628, and 69 deaths gave rise to the ratio quoted; 33 of these were due to respiratory diseases (24 from pneumonia), 13 from bowel diseases, and 11 from remittent fever. At Silchar and outposts the average strength was 579, and 45 deaths occurred, of which 27 were due to bowel diseases and 8 to malarial fever. At Delhi the average strength was 557, and of the 19 deaths 12 were from respiratory diseases (7 from pneumonia) and 4 from malarial fever. At Sipri the average strength was only 30, and there was only 1 death.

Thirteen regiments of the regular army of Bengal suffered a mortality exceeding 20 per 1,000. In eight of these cases (including that of the 3rd Gurkhas) the high ratios were due to active service in Burma. Their ratios varied from 158·02 in the 26th Infantry and 113·64 in the 43rd Infantry to 25·61 in the 16th Infantry and 31·78 in the 27th Infantry. In the 43rd Infantry there were no less than 67 deaths from cholera, of which 6 occurred in Assam, 28 on board ship, and 33 in Burma. Of the other five regiments with a mortality of over 20 per 1,000, the 4th Infantry (132·00) lost men in action at Manipur and Tammu, and a number of men from bowel diseases at Manipur and from cholera at Tammu; and the 42nd Infantry (61·70) a large number of men from cholera at Tammu and on the march near Tammu. Of the remaining three the 14th Cavalry (142·85) was serving in Southern Afghanistan

and had gone thither from Meean Meer; it lost 35 men from respiratory diseases (51 per cent. of present deaths), 13 from bowel diseases, and 12 from fevers. The 22nd Infantry (35·71) was at Delhi, whither it had come from Meean Meer; it lost 18 men from respiratory diseases (72 per cent. of present deaths), and 4 from fevers. The 23rd Infantry (20·99) came to Umballa from Peshin (Southern Afghanistan) only in November of the previous year; it lost 11 men from respiratory diseases (79 per cent. of present deaths). The ratios above quoted include both the deaths of men present with their regiment and those of men absent. On the other hand, the causes of death just given refer only to present deaths, as it is only for them that returns are and can be furnished.

The health of the Punjab Frontier Force was very favourable, the admission (979), daily sick (28), and death-rates (9·83), being the lowest recorded. All the chief heads of disease gave rise to lower admission-ratios than in the previous year, except small-pox, phthisis, eye diseases, abscess and ulcer, and guinea worm. The ratio of admissions from respiratory diseases was reduced from 93 per 1,000 to 62,* the latter ratio being close to the average for the period 1867–76. The actual number of deaths from respiratory diseases was 46, equivalent to 4·31 per 1,000, against 67, or 6·34 in 1885, and against an average of 4·81 in 1867–76. The percentage of deaths to cases treated was 6·98 against 6·47 in 1885 and 7·26 in 1867–76. The highest ratio of admission from all causes was 1,274 at Dera Ismail Khan and outposts, and the lowest, 612, at Murdan and outposts. The highest ratio of mortality was 12·45 at Dera Ismail Khan and outposts, and the lowest, 2·00, at Rajanpur and outposts. Of individual regiments in this force, the 4th Mountain Battery in Upper Burma suffered the highest mortality, namely, 52·17 per 1,000; of the present deaths 5, or 56 per cent., were due to dysentery, and 4, or 44 per cent., to fever. The 1st Mountain Battery at Kohat recorded a ratio of 44·25 from 5 present and 5 absent deaths. The ratio of the 1st Punjab Infantry at Dera Ismail Khan and outposts was 38·52, its present deaths included 6, or 35 per cent., from respiratory diseases, and 4, or 24 per cent., from fevers. The 5th Garrison Battery at Kohat had a ratio of 27·03 from only 2 deaths. The 4th Sikhs at Kohat and outposts was the only other regiment having a death-rate over 20 per 1,000, namely, 20·24; of its present deaths 6, or 55 per cent., were from respiratory diseases.

The statistics of the Central India Irregular Force for the year under report were, on the whole, very favourable, though the admission-rate (719) was slightly higher than that of any year since 1881; while the death-rate fell from 10·17 in 1885 to 6·67. There were only 4 cases of cholera, and that without any mortality. Admission-rates were increased in the case of small-pox, ague, phthisis, scurvy, abscess and ulcer, guinea worm, and injuries; and mortality-rates in the case of small-pox, diarrhœa, circulatory diseases, phthisis, debility, and injuries. The death-rate from respiratory diseases fell from 4·30 in 1885 to 2·10 in 1886. Judging from the admission and daily sick-ratios in the several stations occupied by the force, Erinpura was the most unhealthy, with a daily sick-rate of 26, and an admission-rate of 1,138 per 1,000, being the only station with an admission-ratio of over 900 per 1,000. Ajmere-Beawar and outposts was the most healthy, with ratios of 10 and 322. The highest death-rate was 9·36 at Kherwarah and outposts, and the lowest 1·98 at Goonah. The maximum and minimum of the previous year were Erinpura 22·76 and Ajmere-Beawar 4·81. Among regiments the Erinpura Battalion at Erinpura (with detachments) recorded the highest death-rate (11·63) from 6 present and 4 absent deaths, and the 2nd Horse at Augur (with detachments) the lowest (5·41) from 2 present and 1 absent. The deaths from pneumonia in the whole force in 1886 were fewer than in the Erinpura Battalion alone in the preceding year.

The health of the troops of the Hyderabad Contingent is usually very good; and during 1886 the vital statistics of the force maintained their favourable character. There were in all 34 deaths (5·34 per 1,000 of strength), of which 18 per cent. were due to respiratory diseases and 9 per cent. to phthisis. There were no deaths from cholera, against 7 in the preceding year. The admission and daily sick-rates were highest at Amraoti (1,122 and 28) and at Ellichpur (995 and 31), and lowest at Raichore (269 and 13) and at Aurangabad (325 and 10). The 3rd Infantry had the highest mortality (9·65) from 8 deaths; it served part of the year in Burma. The 5th Infantry at Ellichpur and Amraoti and the 4th at Bolarum came next with 7 deaths each, of which 2 in the former and 6 in the latter were present deaths. None of the four field batteries recorded any mortality.

* These ratios exclude tonsillitis and sore throat, and include only respiratory diseases proper.

Madras Army

The health of Madras troops not on active service was less favourable than in the previous year, especially with regard to mortality, the death-rate having been higher than in any year since 1880. Owing to the influence of the military operations in Upper Burma, all the divisions of the Madras Army, except the Northern, appear to have felt this influence, but, naturally, the garrison of Lower Burma most. The percentage of Burma deaths to the total deaths of the Presidency was in 1886 twice as high as in 1885. Of the deaths of the Madras Army 18 per cent. were due to cholera, 14 to respiratory diseases, 12 to fevers, 16 to debility, 7 to bowel diseases, and 5 to phthisis. Of the deaths of Burma and the Andamans, 44 per cent. were due to debility, and 11 each to fevers and bowel diseases. In the army of Madras there were 128 cases of cholera, against 71 in the previous year. Of the 128 patients, 56 died, or a percentage of 43·75; the percentage in 1885 having been 49·30. Small-pox gave rise to 8 admissions, against 22 in 1885, and fortunately, as in that year, without mortality. There were 28 cases of hepatitis of which 3 ended fatally against 33 and 2 in the previous year.

Sickness and Mortality during the last Ten Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	28,304	861	28	2·79	11·80	14·36
1878	28,728	841	29	2·23	12·25	15·49
1879	27,314	1,269	43	3·19	18·89	21·23
1880	28,710	1,399	54	0·10	15·57	19·54
1881	28,533	997	41	1·37	12·02	16·75
1882	27,654	879	30	2·46	12·01	14·99
1883	27,703	737	27	2·92	10·76	12·51
1884	28,050	836	31	1·46	10·02	11·82
1885*	27,043	675	25	1·29	9·69	13·96
1886†	22,070	756	30	2·54	14·05	21·25

* Excluding men on active service in Burma and Egypt.

† Exeluding men on active service in Burma.

Of the large stations in the Madras Presidency, or occupied by Madras troops, with an average strength exceeding 1,000 men, Secunderabad recorded the highest admission-ratio, namely, 1,028 per 1,000, and next to it Kamptee (825), Belgaum (745), Bangalore (589), and Madras (510); of the stations with a strength between 500 and 1,000, Rangoon recorded 982, Thayetmyo 944, Raipur 868, Jubbulpore 757, and Mangalore 742; while of the stations with a strength under 500, Shwegyin recorded 2,206, the Andamans and Nicobars 2,172, Toungoo 1,258, and Moulmein 944. The highest mortality took place in the Quetta District (50·75) which was occupied for only two months, in Toungoo (30·30) in ten months, in Thayetmyo (29·30), in Rangoon (24·89), and in Shwegyin (22·94) in nine months. In all the other stations the death-ratio was under 20 per 1,000, and in 19 of them it was under 10 per 1,000. Finally, it may be mentioned that among Madras troops on the march there were 51 deaths from cholera. Thirteen regiments of the Madras Army recorded death-ratios exceeding 20 per 1,000. Of them six were serving in Upper Burma, and lost men chiefly from fevers, bowel diseases, cholera, and debility; and three were in the garrison of Lower Burma, and suffered loss mainly from debility, fevers, bowel diseases, and cholera. The 4th Infantry was less than two months of the year in the Quetta District, and was subsequently at Trichinopoly (with a detachment at Ootacamand) but out of its 42 present deaths 36 occurred in Southern Afghanistan. Of its 42 death-losses 52 per cent. were caused by respiratory diseases, principally bronchitis. Its death-ratio was 75·30. The 20th Infantry, which recorded a ratio of 27·33, was five months at Suakin, and afterwards at Kamptee. It lost 15 men at the former station, 4 on the homeward march, and 2 at the latter station; and of the total 21 deaths, 57 per cent. from debility. The 32nd Infantry arrived at Secunderabad from Cuttack (Bengal) in March 1886. Its high death-rate (77·02) was due to the fact that it lost 51 men from cholera on that march. Of its 63 deaths 81 per cent. were due to cholera.

The health of the Bombay Army was considerably improved as compared with the preceding year, though still somewhat unfavourable as compared with other recent years. The cholera mortality was reduced from 5·42 to 0·14, and the total death-rate from 24·84 to 15·98, as noted in the following table :— Bombay Army.

Sickness and Mortality during the last Ten Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877 - - -	23,388	1,074	33	1·93	10·90	12·96
1878 - - -	23,672	1,702	45	2·36	15·12	17 95
1879 - - -	22,854	1,663	51	3·11	20·22	21·90
1880* - - -	15,328	1,283	45	—	10·44	56·53‡
1881* - - -	18,349	1,166	41	1·85	14·01	25·93‡
1882† - - -	23,772	1,067	36	0·46	12·16	13·41
1883 - - -	23,576	994	35	0·47	12·81	14·96
1884 - - -	23,373	1,153	38	0·39	12·96	14 35
1885§ - -	22,701	1,243	43	5·42	24·84	26·01
1886§ - -	21,089	1,231	37	0·14	15·98	20·89

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.
§ Excluding men on active service in Burma and Egypt.

Among the chief diseases the only ones which caused increased ratios of admission were fevers, diarrhœa, venereal diseases, abscess and ulcer, and injuries. The only diseases which caused increased mortality were hepatitis, spleen diseases, circulatory diseases, and injuries. Reduction of mortality was most marked in the case of cholera, which caused only 3 deaths against 123 in the previous year.

Sickness was most prevalent and caused most mortality in the Quetta district and in the Konkan, while the Northern Division was the most healthy part of the Presidency. The Quetta district had the highest ratios both of admission and of death from fevers, bowel diseases, and especially respiratory diseases, the Konkan coming second; of the larger stations with an average strength of over 1,000 men the highest admission and daily sick-ratios were recorded by Quetta District (2,444 and 53), Jacobabad (1,265 and 41), and Bombay (1,106 and 31), and the lowest by Mhow (799 and 38), and Poona (1,064 and 35). Of the stations with an average strength of between 500 and 1,000 men, the highest admission and daily sick ratios were furnished by Baroda (1,561 and 64), Neemuch (1,197 and 31), Nusseerabad (958 and 30), and Hyderabad (910 and 36), and the lowest by Aden (550 and 23). Of all the stations, only one, the Quetta district, had a mortality exceeding 20 per 1,000, namely, 45·73, while 16 stations had mortalities of less than 10 per 1,000. After Quetta district the highest mortalities were those of Deesa (18·68), Kurrachee (17·92), Bombay (17·16), and Aden (15·71). Eight regiments and two depôts had a mortality exceeding 20 per 1,000. The depôts were of very low strength, and had only 3 and 1 death respectively. Of the eight regiments, three were on service in Upper Burma; of them the 5th Infantry had the highest mortality (49·76); its present deaths numbered 38, of which 53 per cent. were from cholera. Four of the eight regiments were in the Quetta district; the highest ratio (123·90) being that of the 20th Infantry, which lost 91 men present with the regiment, 69 per cent. being from respiratory diseases. Finally, the 9th Infantry, which arrived at Aden and its outposts from Bombay in December 1885, had a ratio of 20·43 from 15 present and 2 absent deaths.

Having considered individually the health statistics of the several portions of the Native Army of India in the foregoing paragraphs, it will now be convenient to contrast the main features of each, and for convenience the chief results are brought together in the following table :—

Presidency.	Total Deaths per 1,000 including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army - -	22·29	40,547	1,065	34	1·87	14·45
Madras „ „ - -	21·25	22,070	756	30	2·54	14·05
Bombay „ „ - -	20·89	21,089	1,231	37	0·14	15·98
Central India Irregular Force -	8·22	5,250	719	18	—	6·67
Punjab Frontier Force - -	13·59	10,684	979	28	—	9·83
Hyderabad Contingent - -	6·06	6,370	483	16	—	5·34
India - - -	19·46	106,010	973	31	1·27	13·27

The Hyderabad Contingent, as usual, and the Central India Force show the most favourable results both with regard to admissions and deaths. The highest admission, daily sick, and death-rates were recorded in the Bombay Army, and next to it in the Bengal Army. The highest cholera death-rate was in the Madras Army. There was no mortality from cholera in the Central India Force, Punjab Frontier Force, and Hyderabad Contingent.

Jails.

Sickness and mortality in 1886.

The late progressive annual fall in the average number of prisoners confined in the jails throughout India was arrested in the year under review, and replaced by a rise, which was however not sufficiently great to bring the average strength up to that of any of the years preceding 1885. At the same time the admission and daily sick-rates remained the same as in 1885, and were therefore lower than in any of the years before 1885, except 1883. The death-rate from all causes also fell from 33·54 per 1,000 in 1885 to 31·85, thereby approaching the rate for 1883, which is one of the lowest of the series given in the following table. All three presidencies—Bengal, Bombay, Madras—participated in the reduction of mortality, in the order named. The decrease in mortality from cholera was common to all three presidencies, while that from bowel-diseases obtained only in the Bengal Presidency, but was so great as to more than counterbalance in the ratio for India the increase in the other presidencies. The admission-rates from malarial fevers, from anæmia and debility and from respiratory diseases increased, while those from cholera, bowel-diseases, phthisis, rheumatism, and abscess and ulcer decreased. The death-rates from fevers, from anæmia, from spleen-diseases, from respiratory diseases, &c., were above, while the death-rates from cholera, bowel-diseases, &c., were below those of 1885. Of the deaths, about 34 per cent were due to bowel-diseases, 17 per cent to respiratory diseases, 9 per cent. to anæmia and debility, and 8 per cent each to phthisis and fevers.

Statement showing the Strength, Sickness, and Mortality among the Prisoners of India during the years 1872–76, 1877–81, *and* 1881 *to* 1886.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1872–76 - -	99,758	1,016	?	2·86	13·48	36·24
1877–81 - -	112,670	1,189	45	4·48	24·97	63·01
1881 - - -	100,844	1,214	45	3·03	16·92	44·03
1882 - -	94,063	1,214	42	2·75	15·21	39·96
1883 - - -	88,174	996	36	2·28	10·64	31·37
1884 - -	85,496	1,025	37	1·43	9·73	29·11
1885 - -	82,650	1,014	36	3·44	11·18	33·54
1886 - - -	84,910	1,014	36	1·45	10·70	31·85

The average number of prisoners was in 1886 less than the approximate average during the ten years 1872–81 by 21,304. The proportion of prisoners to the general

population was 4·4 per 10,000, against 4·2 in 1885 and 4·3 in 1884. For the several presidencies the ratios are given in the following table:—

Ratio of Prisoners per 10,000 *of Population in each of the three Presidencies for* 1885, 1884, 1883, 1882, 1881, *and* 1872–86 *compared.*

Presidency.	Period.	General Population, according to Census of 1881.	Prisoners. Average Number.	Prisoners. Proportion to 10,000 of Population.	Prisoners. Deaths per 1,000 of average Strength.
Bengal	1872–76	147,215,384	68,328	4·6	39·39
	1881		63,478	4·3	44·42
	1882		59,489	4·0	42·56
	1883		54,982	3·7	34·28
	1884		51,877	3·5	32·71
	1885		49,404	3·4	38·40
	1886		50,028	3·4	32·32
Madras	1872–76	31,170,631	9,607	3·1	32·37
	1881		10,332	3·3	41·91
	1882		8,752	2·8	42·62
	1883		7,666	2·5	29·87
	1884		6,959	2·2	20·55
	1885		6,942	2·2	17·86
	1886		6,904	2·2	17·53
Bombay	1872–76	16,454,414	8,011	4·9	26·61
	1881		9,910	6·0	41·88
	1882		8,845	5·4	33·35
	1883		7,806	4·7	34·33
	1884		7,305	4·4	34·91
	1885		6,872	4·2	33·76
	1886		6,767	4·1	30·44

Both sickness and mortality were greater in the jails of the Bengal Presidency than in those of the other two presidencies. As in the previous year, the admission-rate in Madras was higher than in Bombay, while the death-rate in Bombay was much higher than that in Madras.

Sickness and Mortality among Prisoners in the three Presidencies during 1886 *compared.*

Presidency.	Average Strength.	Ratio per 1,000. Admissions into Hospital.	Ratio per 1,000. Daily Sick.	Ratio per 1,000. Deaths from Cholera.	Ratio per 1,000. Deaths from Dysentery and Diarrhœa.	Ratio per 1,000. Deaths from All Causes.
Bengal	50,028	1,003	33	1·78	11·81	32·32
Madras	6,904	757	26	—	4·64	17·53
Bombay	6,767	582	25	—	8·87	30·44

In Bengal the admission-rate, daily sick-rate, total death-rate, and death-rates from cholera and from bowel diseases are all more favourable than in 1885. The low mortality of Madras was somewhat more than maintained, in spite of a slight rise in the rate of death from bowel diseases. In Bombay there was a more decided rise in the mortality from bowel diseases, but the total death-rate was considerably diminished. Both in Madras and in Bombay the jails were quite free from cholera.

Sickness in the Bengal Presidency was less prevalent than in any of the other years

Year.	Average Strength.	Ratio per 1,000. Admissions.	Ratio per 1,000. Daily Sick.	Ratio per 1,000. Deaths from Cholera.	Ratio per 1,000. Deaths from Dysentery and Diarrhœa.	Ratio per 1,000. Deaths from All Causes.
1877-81	69,149	1,145	40	3·90	22·32	55·40
1877	63,600	967	30	3·07	10·59	31·88
1878	78,116	1,182	41	5·34	28·27	65·85
1879	73,801	1,285	46	6·38	30·65	77·90
1880	66,751	1,108	40	1·00	21·51	51·12
1881	63,478	1,151	41	3·10	17·91	44·42
1882	59,489	1,178	40	3·11	17·31	42·56
1883	54,982	949	32	2·35	12·93	34·28
1884	51,877	1,028	34	1·52	12·66	32·71
1885	49,404	1,060	36	4·07	14·68	38·40
1886	50,028	1,003	33	1·78	11·81	32·32

in the marginal table, except 1877 and 1883; mortality from all causes and mortality from bowel-diseases less than in any year except 1877; and cholera mortality less than in any year except 1880 and 1884.

Fevers were less prevalent than in the preceding year, but were attended by a somewhat increased mortality. Both the admission and death-rates from fevers were below the decennial average of 1873–82. With the exception of fevers, bowel-diseases, and rheumatism, the chief diseases as given in the following table were more prevalent in 1886 than in 1884. The admission-ratios for fevers, abscess and ulcer, and rheumatism are below, those for diarrhœa and respiratory diseases the same as, and those for the other diseases above, the decennial average.

Statement showing the Chief Diseases which have caused Admissions into Hospital in the Jails of the Bengal Presidency from 1873–1886.

Number.	Diseases.	Decennial Average, 1873–82.	Admitted per 1,000 of Average Strength.													
			1886.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers	488	406	441	452	389	541	528	458	660	556	371	457	398	445	450
2	Abscess and ulcer	116	104	100	94	102	123	127	133	114	113	122	115	99	107	110
3	Dysentery	112	122	137	117	100	117	105	116	129	137	98	104	96	101	110
4	Diarrhœa	103	103	111	106	100	108	106	117	112	107	94	86	90	96	108
5	Respiratory diseases	44	44	40	36	39	45	48	48	21	45	43	41	37	45	44
6	Wounds and accidents	41	43	42	35	36	39	40	37	36	43	48	39	43	44	43
7	Atrophy and anæmia	23	36	34	28	27	28	28	28	29	28	24	19	16	15	19
8	Venereal diseases	17	19	17	18	18	21	20	20	18	18	15	12	23	16	12
9	Rheumatism	17	15	16	16	16	16	15	15	15	16	21	17	16	19	17
10	Eye diseases	13	17	14	13	13	15	13	14	11	13	12	11	11	12	13
	Total of the Ten	973	903	952	915	840	1,053	1,030	986	1,166	1,076	848	901	827	900	927
	Total from all Causes	1,091	1,003	1,060	1,028	949	1,178	1,151	1,108	1,285	1,182	967	1,017	943	1,028	1,043

Diseases of the spleen were the only diseases which caused a higher mortality than the decennial average; and only fevers, anæmia, and spleen diseases had a higher death-rate than in 1885, the ratio from respiratory diseases being practically unchanged, although the admission-ratio from respiratory diseases was increased.

Statement showing the Diseases which have been the chief causes of Mortality amongst Prisoners of the Bengal Presidency from 1873–1886.

Number.	Diseases.	Decennial Average, 1873–82.	Died per 1,000 of Average Strength.													
			1886.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	18·90	11·81	14·68	12·66	12·93	17·31	17·91	21·51	30·65	28·27	10·59	14·75	12·38	16·38	16·63
2	Respiratory diseases	7·18	5·85	5·83	6·03	6·00	7·26	7·62	9·38	9·53	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers	5·29	2·82	2·49	2·16	2·38	3·53	4·65	4·45	13·82	7·40	1·97	2·36	4·20	3·72	5·47
4	Cholera	3·46	1·78	4·07	1·52	2·35	3·11	3·10	1·00	6·33	5·34	3·07	4·24	2·35	2·48	2·97
5	Atrophy and anæmia	3·10	2·60	2·49	2·10	2·02	3·04	2·58	3·66	5·43	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis	2·50	2·24	2·41	2·12	2·31	1·98	2·24	2·53	3·00	2·76	2·36	3·24	1·86	2·51	2·33
7	Wounds and accidents	0·68	0·51	0·69	0·46	0·44	0·62	0·55	0·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
8	Apoplexy	0·66	0·52	0·63	0·52	0·60	0·30	0·58	0·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
9	Spleen diseases	0·35	0·38	0·20	0·27	0·34	0·19	0·22	0·57	0·31	0·23	0·20	0·29	0·77	0·37	0·33
	Total of the Nine	42·12	28·54	33·49	27·84	29·37	37·34	39·45	44·61	70·54	59·80	27·84	33·63	29·36	34·85	38·21
	Total from all Causes	47·36	32·32	38·40	32·71	34·28	42·56	44·42	51·12	77·90	65·85	31·88	37·51	33·65	39·90	43·08

Among fevers 8 cases of enteric with 6 deaths (75 per cent.) and 28 cases of cerebrospinal fever with 19 deaths were returned. The death-rate of bowel diseases may be thus analysed :—

1886.		1885.	
Dysentery	7·61	Dysentery	10·16
Diarrhœa	4·20	Diarrhœa	4·52
	11·81		14·68

This shows, which is satisfactory, that the chief reduction was in dysentery.

The Gangetic Provinces and Oudh group, with an admission-rate of 612 and a daily sick-rate of 24, was, as in the two preceding years, the most healthy; while the Bengal and Assam group, with an admission-rate of 1,448 and a daily sick-rate of 49, was the most unhealthy. The Central Provinces were next to Bengal and Assam in unhealthiness, and in healthiness Central India came next to the Gangetic Provinces. The same contrast as noticed in last year's report between the Punjab and the Central Provinces obtains also in the year under review. The former with an admission-rate of 1,082 had a daily sick-rate of only 26 and a death-rate of only 28·46: while the latter with an admission-rate of 1,078 had a daily sick-rate of 39 and a death-rate of 67·13. This death-rate of the Central Provinces was much the highest of all the groups, and, although it was lower than in 1885, contained the bad element of a decided rise in bowel-disease mortality. There were no deaths from cholera in the Central India and Punjab groups, and only in the Rohilkhand and Meerut group was there an increase of mortality from that disease. All the groups were below the quinquennial average in mortality, and except Rohilkhand and Meerut and the Punjab, they were farther below it than in the previous year.

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged in Groups in accordance with their Geographical Positions) from 1877–81, 1882, 1883, 1884, 1885, *and* 1886.

Groups.		Average Strength.	Ratio per 1,000.					Difference between Average Mortality and Year's Mortality.
			Admissions into Hospital.	Daily Sick.	Deaths from			
					Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam	1877–81	14,788	1,519	50	7·43	31·63	67·50	−23·53
	1882	13,327	1,693	54	8·25	25·44	59·95	
	1883	12,414	1,630	53	4·03	22·64	52·52	
	1884	12,250	1,586	55	4·24	25·06	57·71	
	1885	12,148	1,642	58	7·24	28·73	60·50	
	1886	12,076	1,448	49	4·14	17·97	43·97	
II.—Gangetic Provinces and Oudh	1877–81	22,769	695	25	3·21	13·98	33·29	−11·85
	1882	13,515	724	28	3·19	14·36	33·70	
	1883	16,846	616	23	3·32	8·67	25·76	
	1884	15,822	629	24	0·88	8·91	21·05	
	1885	15,347	678	25	5·08	8·93	27·63	
	1886	15,949	612	24	0·56	7·40	21·44	
III.—Central Provinces (excluding Jubbulpore and Saugor)	1877–81	3,002	983	36	11·39	26·11	69·88	− 2·75
	1882	2,833	1,106	48	4·24	49·42	89·66	
	1883	2,609	1,003	41	4·22	60·56	88·54	
	1884	2,259	902	34	0·44	22·13	45·15	
	1885	2,285	938	38	15·32	29·76	68·71	
	1886	2,458	1,078	39	10·17	32·14	67·13	
IV.—Agra and Central India	1877–81	5,338	1,063	49	2·89	17·16	51·33	−17·64
	1882	4,513	763	28	0·89	6·65	27·92	
	1883	4,359	556	21	2·75	6·19	21·56	
	1884	4,224	640	24	0·24	7·34	19·89	
	1885	3,835	779	33	—	17·47	38·07	
	1886	3,651	892	32	—	12·87	33·69	
V.—Rohilkhand and Meerut	1877–81	9,072	935	40	0·35	15·30	37·59	− 8·42
	1882	7,187	1,007	38	—	7·65	25·46	
	1883	6,627	753	31	—	3·62	18·26	
	1884	6,054	1,074	34	1·82	7·93	25·60	
	1885	5,321	1,209	41	—	10·34	28·38	
	1886	5,142	1,051	37	0·97	8·36	29·17	
VI.—Punjab	1877–81	14,180	1,674	51	2·38	31·64	88·13	−59·67
	1882	13,115	1,546	45	—	15·25	41·63	
	1883	12,128	951	27	—	6·18	29·11	
	1884	11,268	1,131	27	—	7·10	28·04	
	1885	10,468	1,000	25	—	4·68	27·13	
	1886	10,752	1,082	26	—	8·09	28·46	

All the ratios for 1886 in the jails of the province of Bengal Proper were much more favourable than those for 1885. The admission and daily sick rates (1,323 and 45 per 1,000) were lower than in any year since 1878; only 1880 had a lower cholera

mortality; while the total death-rate (38·30) and the death-rate from bowel-diseases (16·87) were lower than in any of the other years, and much below the decennial average. So that the health of the jails of Bengal Proper in 1886 as compared with previous years, was very exceptionally good.

The admission and daily sick-rates of the seven jails which had an average strength of over 500 were as follows:—Alipore, 1,639 and 53; Dacca, 1,531 and 46; Midnapur, 1,385 and 57; Rajshahai, 1,321 and 74; Buxar, 1,160 and 34; Presidency 1,131 and 45; Bhagalpur Central, 774 and 30. Of these jails three show an admission-rate from fevers of over 500 per 1,000, viz., in order, Buxar, Rajshahai, Midnapur; remittent and simple continued fevers being most prevalent in the Rajshahai, Presidency, and Alipore jails. In the Alipore jail there were 18 admissions and 12 deaths from cerebrospinal fever. Among the same seven jails only Midnapur, Bhagalpur, and Buxar show a slightly increased mortality as compared with that of the previous year: the others all show a considerable decrease. The highest mortality from all causes (90·19) occurred in the Rajshahai jail, and the lowest (14·18) in the Buxar jail. Deaths from cholera occurred in the Buxar, Dacca, Midnapur, and Presidency jails, the highest ratio being 4·45 in the Buxar jail. Among the same seven jails the highest admission-rates for bowel-diseases were recorded at Dacca (789) and Midnapur (483), and the lowest at Buxar (77) and the Presidency (164). Only at Midnapur, Bhagalpur, and Buxar were the admission-rates for those diseases higher than in the previous year. The greatest number of deaths from bowel-diseases occurred at Rajshahai (35) and Midnapur (25); and there were more deaths than in the previous year only at Midnapur and Bhagalpur. The greatest number of deaths from respiratory diseases occurred in the Dacca and Rajshahai jails, and the greatest number of deaths from phthisis in the Alipore jail. Taking next the 31 jails which had a strength of less than 500 and not less than 100, we find that six of them had an admission-rate of over 2,000 per 1,000, the highest rate, 2,502, being that of Furreedpore, where the strength was 221; and 16 of them an admission-rate of over 1,000. In the same group the most healthy jails were Jalpaiguri (324 admission and 18 daily sick-rate) and Hazaribagh (478 and 20). It is unusual for the Jalpaiguri jail to be so healthy, and the Inspector-General explains this unusual healthiness of Jalpaiguri as well as of the Bengal jails generally by the unusual infrequency of malarial affections in 1886. In the preceding year the ratios for Jalpaiguri were 1,615 and 60, and for Hazaribagh 1,201 and 36. Of the 45 jails in Bengal Proper, sickness and mortality increased in 19, and diminished in 26, as compared with the previous year. The highest mortalities occurred in Dinagepore (119·32), due chiefly to bowel diseases, respiratory diseases, and phthisis; in Tipperah (103·23), due mostly to cholera; in Bhagalpur District (94·94), due mainly to cholera, bowel diseases, and respiratory diseases; in Rajshahai (90·19), where out of 57 deaths 35 were from bowel diseases, 9 from fevers, and 8 from respiratory diseases; and in Darjeeling (86·96), due for the most part to debility and bowel diseases. The smallest mortalities occurred at Balasore (11·36), Buxar, Chumparun, Burdwan, and the Presidency (17·21). Some jails, such as Burdwan, &c., show a very marked improvement as compared with the previous year. Of the total mortality a proportion of over 20 per 1,000 was due to cholera in the case of Tipperah, Bhagalpur District, and Pooree. The greatest number of cases of cholera occurred at Tipperah (14) and at Bhagalpur District (7). Of the total admission-rate a proportion of over 700 per 1,000 of strength was from bowel diseases in the Khoolnah, Furreedpore, Chittagong, Tipperah, Chumparun, Bogra, Mymensingh, Pooree, Chybassa, Dacca, Purneah, and Pubna jails. The highest proportion of remittent and simple continued fevers in the total admission-rates occurred in the Cuttack and Jessore jails. Scurvy was reported from eight jails, the highest proportion being at Ranchee. The greatest number of deaths from fevers occurred in the Alipore and Rajshahai jails; from bowel diseases in the Rajshahai and Midnapur jails; from respiratory diseases in the Dacca and Rajshahai jails; from phthisis in the Alipore jail. There were no deaths from small-pox.

The health of the jails of the North-Western Provinces and Oudh, as judged by the admission and daily sick rates (665 and 27 per 1,000), was better than in 1885, and good as compared with that of other years; and, although the total death-rate (22·65) was somewhat raised, the death-rates from cholera (0·40), and from bowel diseases (6·33), were lower than in the previous year. The death-rate from all causes has been increasing by about 1 per 1,000 per annum since 1883. In 1886 the increase of mortality was mainly under the heads of fevers, hepatitis, respiratory diseases, and anæmia and debility. The ratio of admission was increased in the case of respiratory

diseases, phthisis, anæmia, eye-diseases, abscess and ulcer, and hepatitis, and diminished in the case of bowel-diseases, fevers, and the other chief diseases.

There were six jails with an average strength of over 1,000, the Benares, Lucknow, Fatehgarh, Allahabad, Agra, and Bareilly Central Prisons. (The Meerut Central Prison has been abolished on account of unhealthiness.) The highest admission and daily sick rates were 777 and 37 at Agra, and the lowest 279 and 13 at Lucknow. The highest death-rate was 37·82 at Allahabad, and the lowest 14·95 at Benares. The highest admission-rate from fevers was 387 at Agra. Allahabad had most remittent and simple continued fever. In all the admission-rates from fever were lower than in the previous year. The highest admission-ratios from bowel-diseases were at Agra and Bareilly; only in Lucknow and Agra were these ratios higher than in the preceding year. There were no deaths from bowel-diseases in the Fatehgarh Central Prison, and in none of these large central prisons were there more than 8 deaths from bowel-diseases. Cholera occurred only in the Bareilly Central Prison (3 cases with 2 deaths). Much the highest admission and death-rates from respiratory diseases were recorded by the Agra Central Prison, and most of the six large jails had an increase of admissions or of deaths, or of both. Admissions and deaths from phthisis were highest in Allahabad, and, except in the case of that jail, there was on the whole a diminution of phthisis. It is noteworthy that the district jails, containing only short-term prisoners, which are situated in the same stations as the large central prisons, tend to have a higher or an equal ratio of admission from phthisis. This appears to indicate that the conditions of life in the large prisons are not more conducive to phthisis than the conditions of life among the same class of men outside jail. There was most anæmia and debility in Fatehgarh, and most mortality from the same in Allahabad. All six seem to have been very free from scurvy and from sloughing ulcer. In 24 jails sickness was greater than in the previous year, while in 27 it was less. Mortality was increased in 33 jails, diminished in 17, and stationary in one. The highest mortality rates were at Bulandshahr (69·18), due principally to bowel diseases; at Saharunpur (65·93), to bowel and respiratory diseases; at Meerut (54·91), to respiratory diseases; at Gorakhpur (52·33), to bowel-diseases and cholera; at Aligarh (52·26), to bowel and respiratory and various diseases. In all the above cases, except that of Gorakhpur, the rates were higher than in the previous year. Cholera caused 3 deaths each in the Gorakhpur and Shahjahanpur jails, and 2 in the Bareilly Central Prison. Scurvy was reported from the Sitapur, Cawnpore, and Allahabad District jails, the highest ratio being in the Cawnpore jail.

The health of the Punjab jails was not so favourable as in 1885. The admission and daily sick-rates (1,082 and 26 per 1,000) were higher than in the previous year (1,000 and 25), though not so high as in 1884. The death-rate (28·46), though higher than than of the preceding two years, was low when compared with the rates of other years. The rate of mortality from bowel diseases (8·09), was very considerably higher than that of 1885 (4·68), and was even higher than it had been during the two preceding years. As in the four years preceding, there was no cholera mortality. Respiratory diseases gave rise, as usual, to the largest proportion of deaths, 9·21 per 1,000, against 11·27 in 1885, but in the year under review they were closely followed by bowel-diseases, with a proportion of 8·09 per 1,000 against 4·68 in 1885. For the period 1859-76, the average for respiratory diseases was 5·70, and for bowel-diseases 9·44.

Of the 34 jails three showed an admission-rate of over 2,000, viz., the Lahore Female Jail (4,347), the Dera Ismail Khan Jail (3,161), and the Delhi Jail (2,035); while seven had an admission-rate of over 1,000 but under 2,000, among them, being the only two jails with a strength over 1,000,—Lahore Central Prison and Chináwán Central Prison. Excluding three jails with a strength of less than 50, we find that in 17 the admission-rate increased, in 14 decreased, as compared with the previous year. Mortality increased in 15, diminished in 13, and remained stationary in three. Sialkot and Shahpur had no mortality either in 1886 or in 1885. The highest mortalities occurred at Lahore Central (54·19), due to bowel-diseases, respiratory diseases, fevers, and phthisis; at Delhi (43·35), chiefly due to bowel and respiratory diseases; at Dharmsala (44·94); at Chináwán (44·20), due mainly to respiratory diseases, bowel-diseases, and fevers; at Bannu (42·94), and at Amritsar (37·15). Of the above the mortality at Delhi and Amritsar was less and at Dharmsala not more than in the previous year. The unhealthiness of the Lahore Central Prison was attributed partly to the large number of old weakly long-term prisoners, and partly to malarious influences. The high mortality of the Chináwán Jail, where the prisoners are employed on hard extramural labour, was due very specially to pneumonia, to bowel-diseases, which attacked others beside the prisoners, and to continued fevers. The specific continued fevers diagnosed were cerebrospinal, which caused 7 deaths, and typhus,

which was not fully recognised and acknowledged till late, but is supposed to have been at the bottom of many of the cases of pneumonia.

Though the admission-rate of the jails in the Central Provinces was unusually high (1,165 against 983 per 1,000 in 1885), there was nevertheless a substantial reduction in the rates for daily sick (37 per 1,000 against 38 in 1885), deaths from all causes (65·07 against 74·33), deaths from bowel-diseases (31·30 against 37·02), and deaths from cholera (6·87 against 10·36). The increase of the admission-ratio took place under the heads of many of the chief diseases,—fevers, bowel-diseases, respiratory diseases, abscess among others. It was under the heads of cholera and bowel-diseases that the greatest reduction in mortality took place.

Of the 19 jails in the Central Provinces, Raipur, Nagpur, and Jubbulpur had a strength of over 500, and five others a strength of over 100. Of these two classes the highest admission rates were furnished by Nagpur (1,622), Jubbulpur (1,430), Saugor (1,171), Narsinghpur (897), and Raipur (890), Nagpur (449) and Saugor having had the highest proportion of admissions from fevers, Jubbulpur (651 per 1,000), and Nagpur the highest proportion from bowel-diseases; Saugor (72 per 1,000), and Nagpur the highest proportion from respiratory diseases; Jubbulpur and Raipur from anæmia and debility; Nagpur from scurvy. The highest mortalities in jails over 100 in strength were at Sambalpur (145·25), due nearly entirely to cholera and bowel-diseases; at Nagpur (97·59), due mainly to bowel-diseases, and also to respiratory diseases, anæmia, and scurvy; at Jubbulpur (66·06), to bowel-diseases and anæmia and debility, and at Raipur (61·86) to bowel-diseases and cholera. The mortality at Sambalpur and Nagpur was over and that at Jubbulpur and Raipur under that of the previous year. Taking all the jails together, we find that in 10 the admission rate was increased, in 8 diminished, and in 1 unaltered, while in 7 the mortality was increased, in 10 diminished, and in 2 unaltered, as compared with the preceding year. There were in all 237 deaths, of which 114, or over 48 per cent., were from bowel-diseases.

The admission and daily sick rates (489 and 11 per 1,000) of the Berar jails were lower than in the previous year (549 and 13). Cholera mortality was again reduced to zero, and, though there was a rise (from zero to 0·92) in the mortality from bowel-diseases, the death-rate from all causes (11·04) was reduced by 8·10 per 1,000 of strength. The ratio of 0·92 for bowel-diseases represents only one death from diarrhœa; there were no deaths from dysentery. There were fewer admissions but more mortality from fever than in the previous year, whereas respiratory diseases caused a higher ratio of admission but a lower ratio of death.

The Amraoti Jail recorded an admission-rate of 581 and a death-rate of 5·21, against 586 and 16·35 in 1885. In the Akola Jail an admission-rate of 388 and a death-rate of 16·88 were recorded against 561 and 21·19. The total number of deaths in the Berar jails was 12, against 20 in 1885, 8 in Akola, 2 in Amraoti, and 1 each in Ellichpur and Bassim. Five deaths from fever occurred in the Akola Jail, 2 from respiratory diseases at Amraoti, and one from bowel disease at Ellichpur. Neither cholera nor scurvy were recorded.

Owing to civil disturbances and military operations, many of the Burma jails were overcrowded with men who had suffered many privations prior to admission. This partly explains the high daily sick-rate (41 per 1,000), and the high death-rates from all causes (61·55), and from bowel diseases (22·26). At the same time the admission-rate (783 per 1,000) is lower than in the preceding year (869), and lower than in any other year since 1877. It is also lower than the average of 1877–81. The cholera mortality was not half so great as in 1885. The principal diseases in which there was a reduction of the admission-rate were cholera, ague, diarrhœa, respiratory diseases, abscess and ulcer, &c. On the other hand there was an increase in the admission-rates from remittent fever, dysentery, hepatitis, phthisis, anæmia and debility, and scurvy. Except in the case of cholera, small-pox, and diarrhœa, the death-rates of all the chief diseases were increased, the rates being particularly high in the case of bowel diseases and anæmia. Deaths from sloughing ulcer also took place, especially in the Rangoon Jail. There were altogether 506 deaths against 295 in 1885.

In the following remarks the Sandoway and Mergui Jails are left out of consideration as being of too inconsiderable a strength. All the jails, except Akyab and Kyaukpyu, show an increase of strength as compared with the previous year. Only two jails had a strength of over 1,000, Rangoon 3,366 and Moulmein 1,332. The only admission-rates over 1,000 were 1,427 at Shwegyin, 1,247 at Akyab, and 1,014 at Rangoon. Of these three jails Rangoon had a lower admission-rate than in the previous year. In 7 of the 12 jails the admission-rate was increased and in 5

diminished. Mortality increased in 6 and diminished in 6 jails. The highest death-rates were at Shwegyin (140·70), Akyab (99·24), and Rangoon (78·13); but in 8 of the 12 jails the death-rate was over 40 per 1,000. At Shwegyin the principal causes of admission were, in order, bowel diseases, fevers, anæmia and debility and respiratory diseases; at Akyab bowel diseases, fevers, and anæmia and debility; and at Rangoon fevers (remittent and continued fever being more prevalent than in other jails), anæmia and debility, and bowel diseases. With regard to bowel diseases, fevers, and respiratory diseases, these 3 jails stood in the following order—Shwegyin, Akyab, Rangoon; but in respect of anæmia and debility their order was—Rangoon, Akyab, Shwegyin. At Shwegyin there were 28 deaths, of which 21, or 75 per cent., were from bowel diseases, and at Akyab 39, of which 31, or 79 per cent., were due to this cause. The percentage distribution of the causes of the 263 deaths in the Rangoon Jail, was as follows:—bowel diseases 34, anæmia and debility 21, respiratory diseases 11, phthisis 5, sloughing ulcer 4, fevers 3, scurvy 2, and other diseases 20. This jail was one of those which received a large number of broken down dacoits. In the previous year its deaths numbered only 75, and its death-rate was 27·26. Seven jails were invaded by cholera, especially Henzada (42 cases with 17 deaths) and Toungoo (11 cases with 8 deaths). Scurvy occurred in 4 jails, the highest ratios being in the Rangoon and Kyaukpyu Jails. There were no deaths from small-pox.

There was a substantial reduction in the ratios to average strength of admissions (1,982 per 1,000 against 2,217 in 1885), daily sick (63 against 67), and deaths from bowel diseases (21·53 against 27·85), in the jails of Assam. There was a great rise in the death-rate from cholera (13·78 against 5·91 in 1885), otherwise the death-rate from all causes (63·73) would have been lower than in the previous year. The lessening of the admission-rate was chiefly due to the diminished frequency of fevers, respiratory diseases, phthisis, and rheumatism; for there was an increase in bowel diseases, debility, abscesses, &c. The most important diseases caused less mortality than in 1885, except cholera and respiratory diseases.

The Sylhet Jail with the highest strength was the only one which recorded in 1886 a rate of admission of over 2,000 per 1,000, but in all the rate exceeded 1,000. All the death-rates were over 40 per 1,000, the highest being Shillong (128·21) from 5 deaths on a strength of only 39, Gauhati (92·59), and Sylhet (68·97). More than half the mortality at Gauhati was due to cholera, and the remaining deaths, except 1, were from bowel diseases. Of the 30 deaths at Sylhet, 10 were from bowel diseases, 7 from cholera, 4 from fevers, and 3 each from respiratory diseases and anæmia. Ague was most prevalent at Gauhati, remittent and simple continued fevers and bowel diseases at Sylhet. Sylhet had the greatest number of deaths from bowel diseases. The total number of deaths in the Assam jails was 74, of which 34 per cent. were from bowel diseases and 22 per cent. from cholera. At Gauhati the cholera was of so virulent a type that of the 9 men attacked all died, whereas at Sylhet there were 13 cases with 7 deaths, and in the lock-ups 2 cases without death.

Although some of the ratios of the Madras jails were less favourable than in the previous year, the health of the Madras prisoners was good. The admission and daily sick-rates (757 and 26 per 1,000) were increased, but though the mortality from bowel diseases (4·64) was slightly higher, the death-rate from all causes (17·53) was less than in 1885 (17·86), and thereby became the lowest on record. There was no mortality from cholera. The rates of admission from cholera and bowel diseases were diminished, while those from fevers, anæmia, respiratory diseases, and phthisis were increased. The decrease of mortality under the heads of cholera, small-pox, heat-stroke, phthisis, injuries, and minor diseases was enough to more than counterbalance an increase from all the other major diseases. Out of the total of 121 deaths 32, or 26 per cent., were contributed by bowel diseases, 18, or 15 per cent., by anæmia and debility, and 16, or 13 per cent., by respiratory diseases.

All the 7 central jails had a strength of over 300, and 5 of them over 500. Of these the Cannanore Jail was by far the most unhealthy. The only admission-ratios over 1,000 were those of Cannanore (1,673) and Rajamundry (1,302). The height of the latter ratio was due to ague; but Cannanore, as compared with the other six jails, had the highest proportion of remittent and simple continued fever, of bowel diseases, of respiratory diseases, of phthisis, of anæmia and debility; and was the only one which recorded scurvy. The highest death-rates were 44·23 at Cannanore, and 20·06 at Coimbatore. The death-rates of the remaining five were all below 15 per 1,000, the lowest being 4·15 at Vellore. There were 18 deaths in the Cannanore Jail, of which 6 were from bowel diseases, twice as many as in any of the other six jails. At Coimbatore occurred the next greatest number of deaths, 13, of which 3 were

from bowel diseases and 6 from anæmia and debility. It may be said, speaking generally, of the Madras jails in 1886, that those near the sea-coast had increased sickness, while those farther inland had less. Eleven had more sickness and 11 less, while 8 had a higher mortality and 14 a lower or unchanged mortality. Chittoor, Madura, Guntoor, and Russellcondah had admission-rates of over 1,000, Chittoor 3,702, chiefly due to fevers. One non-fatal case of cholera occurred in the Trichinopoly Central Jail.

Except in the greater mortality from bowel-diseases (8·87 against 5·68 in 1885), the health of the Bombay prisoners was better than in the previous year. The daily sick-rate (25 per 1,000) remained unchanged, the admission and death-rates (582 and 30·44) were reduced, and became the lowest since 1877, while cholera-mortality entirely disappeared. Increased admission-ratios were caused by remittent and continued fevers, spleen diseases, and abscess and ulcer, and diminished ratios by ague, bowel diseases, anæmia and debility, scurvy, respiratory diseases, and phthisis. There was increased mortality from bowel diseases, scurvy, anæmia and debility, and respiratory diseases, and lessened mortality from spleen diseases, cholera, fevers, and phthisis. Of the total 206 deaths 62, or 30 per cent., were from respiratory diseases, 60, or 29 per cent., from bowel diseases, 16, or 8 per cent., from anæmia and debility, and 14, or 7 per cent., from fevers.

Jails with a strength of less than 50 are here left out of consideration. There were five jails with a strength of over 500, and one with a strength of nearly 500. Of these six, Shikarpur and Yerrowda had the highest admission-rates; but in both cases these rates were lower than in the previous year. None of them had an admission-rate of over 1,000. Tanna had the highest proportion of admissions from remittent and continued fevers, bowel diseases and phthisis; Shikarpur from ague and scurvy; the Nara gang from respiratory diseases; and the Bijapur gang from anæmia and debility. The highest death-rates were 64·91 at Nara, 57·03 at Hyderabad, and 43·31 at Shikarpur. At Hyderabad 63 per cent. of the deaths were from respiratory diseases, and 10 per cent. from bowel diseases; at Nara 44 per cent. from respiratory diseases, and 28 per cent. from bowel diseases; and at Shikapur 41 per cent. from respiratory diseases and 27 per cent. from bowel diseases. The admission-rate in 12 out of the 25 jails was increased, and in 13 diminished. The mortality increased in 9, diminished in 13, and remained unchanged in 3. The greatest amount of increase in the death-rate from bowel diseases was in Tanna, Shikapur, and Yerrowada, in the order named. The increase at Tanna was from 1·84 to 20·33. Among the smaller jails, the highest admission-rate (1,143) was at Ahmednagar, and the lowest, 245, at the Bombay House of Correction, while the highest death-rate was 46·15 at Aden, and 45·45 at Satara, and the lowest 3·92 in the Bombay Common Jail.

The health of the Convict Settlement at the Andamans was less favourable than in the previous year; indeed the admission and death-rates (1,658 and 20·33) were higher than for three years past. The same is true of the mortality from bowel diseases (3·53), and the daily sick-rate (57) was also increased. There was a great increase in the admission-ratio from ague, and the ratios from respiratory diseases, phthisis, anæmia and debility, and scurvy were also increased. There were no deaths from cholera, small-pox, hepatitis, or scurvy. Mortality was diminished in the case of respiratory and spleen diseases, and increased in the case of fevers, bowel-diseases, phthisis, anæmia and debility, and injuries. Next to fevers the highest admission-rates were due to injuries, then to abscess and ulcer, then to respiratory and bowel diseases. With a strength of 11,903 against 11,551 in 1885, there were 242 deaths against 204. Of the deaths 17 per cent. were due to bowel diseases, 16 to phthisis, 15 to respiratory diseases, 12 to injuries, and 10 to fevers. In the previous year also, phthisis was second, but bowel diseases occupied the third place and respiratory diseases the first.

General remarks.

Judging by the admission-rates, the jails of Assam and the Andaman Convict Settlement were the most unhealthy, while Berar and Bombay were the most healthy. The Central Provinces again recorded the highest death-rate, followed next by Assam and Burma; while the lowest death-rates were those of Berar and Madras. The high admission-rate of Assam was accompanied by a high death-rate, while only a low death-rate accompanied the high admission-rate of the Andamans. Taking admission and death-rates into consideration together, the jails of Assam and of the Central Provinces were the most unhealthy, those of Berar and Madras the most healthy.

General Population.

Registration of births and deaths in India.

The birth ratios generally for India as whole were lower than those of the previous year. The approximate average birth-rate for all the provinces of India combined as shown in the following table, was 30·31, against 32·80 in 1885. The provinces which contributed most conspicuously to lowering the general birth-rate were the Central Provinces and Berar, although every province except the Punjab, Madras, and Bombay, recorded lower ratios than in the preceding year. The highest ratio in India was recorded this year in the Punjab (39·47), this place being usually held by the Central Provinces and Berar, whilst the lowest ratio, omitting Coorg, was recorded in Bengal (21·04). The maximum ratio recorded in any single district was 51·60 in North-Western Provinces and Oudh, and the lowest 10·10 in Lower Burma. The most uniform district results were obtained in Berar, where the difference between the maximum and minimum ratios was only 10·8, whilst the most divergent results were recorded in the Punjab, where this difference amounted to 38·94.

Province.	Birth-rate.		Death-rate.		Excess of Deaths over Births in 1886.
	1886.	1885.	1886.	1881–85.	
Bengal	21·04	24·71	21·99	20·35	7·64*
North-Western Provinces and Oudh	37·62	41·24	33·27	32·05	—
Punjab	39·47	38·84	27·00	28·00	—
Central Provinces	37·79	45·36	33·24	31·73	—
Berar	37·30	42·90	36·70	33·70	—
Lower Burma	22·57	25·51	15·54	17·08	—
Assam	27·55	27·95	27·77	25·23	0·22
Madras	30·40	29·30	19·70	19·3	—
Bombay	35·34	34·79	23·17	24·64	—
Coorg	14·04	17·48	20·33	18·23	6·29

* Refers to 45 Municipal towns in which births were recorded.

The approximate death-rate for all provinces combined was 25·87, against 25·03 the approximate mean of the previous five years. There has been therefore remarkably little change. Comparing the ratios of each province with its quinquennial mean, it is seen that in only three, namely, the Punjab, Burma, and Bombay were those of the year less than the means. Of the provinces showing a greater ratio, the Central Provinces and Berar stand first. The highest mortality was recorded in Berar (36·70). Central Provinces and North-Western Provinces and Oudh coming next with ratios above 30 per 1,000. The lowest ratios are those of Burma (15·54) and Madras (19·70). The most uniform results were obtained in Berar where the difference between the maximum ratio in any district and the minimum amounted to 6·6, and the most divergent results in North-Western Provinces and Oudh, where the difference equalled 41·23. In all provinces except Bengal, Assam, and Coorg, the births exceeded the deaths.

Cholera gave rise to the highest mortality in Assam, small-pox in Madras, fevers in North-Western Provinces and Oudh, and bowel-complaints in Berar.

The hopes entertained that more reliable statistics in the province of Lower Bengal would have been obtained from the transfer of the work of collecting them to municipal agency, have not been realised. Indeed the results of the year under report are even worse than those of the preceding year. The average birth-rate for this, the most populous province of India, as estimated from the results of birth registration in 45 principal towns, is only 21·04, a ratio manifestly much under the truth. In the preceding year it was 24·71. The individual ratios varied from 4·46 in Arrah, to 43·72 in Jamalpur. The total death-rate was 21·99, against 22·74 in the preceding year, and 20·35, the mean of the previous five years. The district ratios varied from 13·24 in Mozufferpore, to 40·5 in the suburbs of Calcutta. The imperfection of these statistics is further proved by the fact that in the 45 principal towns, in which birth registration is attempted, the deaths exceeded the births in 31, the mean excess of deaths in these towns being 7·64 per 1,000 of population. In Calcutta the birth-rate was 18·06, against 19·29 in 1885, and the death-rate 26·42, against 29·33. The health of the European seamen in the port of Calcutta was not so good as it was in 1885. The admissions into hospital were 2,714 against 1,976, and the deaths 105 against 52, or stated in ratios per 1,000 of population, 45·14 against 30·71 in 1885. The

increased sickness and mortality was due mainly to cholera, enteric fever, malarious fever, and sunstroke. The health of the Native floating population cannot be so easily estimated as that of the Europeans, but so far as statistics are available, they tend to show that the Natives did not suffer so much as in the previous year, and that in both years their health was remarkably good.

The birth-rate of the North-Western Provinces and Oudh was 37·62; it varied from 51·60 in Lalitpur to 24·14 in Kumaun. The proportion of male to female births was 111·28 males to every 100 females; in every district the male births exceeded the female, varying from 2·17 per cent. in Garhwal, to 26·58 in Dehra Dun. Of the 49 districts of this province, 32 registered a greater birth than death ratio. In 106 municipalities the average birth-rate was 35·06 per 1,000, varying from 16·57 in Naini Tal, to 49·91 in Tanda (Fyzabad). The above ratios are all calculated on the census population of 1881, but by taking into account the "natural increase" of population since that time, an addition of 2,109,314 must be made to the census figure, and the Sanitary Commissioner shows that the true birth-rate in such case would be 35·8 or "a little higher than the rate prevailing in England." The total death-rate was 33·27, varying from 20·42 in Dehra Dun to 61·65 in Moradabad. Taking the natural increase into consideration, the total death-rate would be 31·75 per 1,000. The mean provincial death-rate during the previous five years was 32·05, composed of district elements varying from 21·10 in Kumaun, to 50·05 in Tarai. The greatest number of deaths were recorded in the last five months of the year, and of these months the worst were September, October, and November. It is observable that up to the age of 10, male deaths were greater than female: during 10–15 years they were about equal, the female deaths preponderating slightly; from 15 to 30, female deaths exceed; thereafter the male deaths again preponderate. The rural mortality was 33·01, varying from 19·68 in Dehra Dun, to 64·02 in Moradabad, whilst the town mortality was 36·74, varying from 15·49 in Mahaban (Muttra), to 64·89 in the city of Bulandshahr. In cantonments the mortality was 22·36. Of the 106 municipalities for which data are available in the province, the average mortality was 37·22, varying from 16·86 in Hathras (Aligarh district) to 64·89 in Bulandshahr.

The total birth-rate of the Punjab, estimated on the census population of 1881, was 39·47 per 1,000, varying from 11·34 in Simla or 17·03 in Peshawar to 50·28 in Gurdaspur. Male births exceeded female births in every district, and for the province as a whole by 15·23 per cent., varying from 8·81 in Gurdaspur to 70·69 in Peshawar. Of the 31 districts in the province, all but two recorded a higher birth than death rate, the exceptional districts being Delhi and Simla. But since the population of 1881 a natural increase of 819,304 should be added to the population basis in estimating the true birth-rate, which would then be 37·82, still a high rate compared with that of England. In cantonments, including Hill Stations, the birth-rate was 12 per 1,000. The total provincial death-rate was 27 per 1,000, against 28, the mean of five years varying from 11 in Dera Ghazi Khan to 40 in Delhi. Taking natural increase, however, into consideration, the death-rate was 25·4 per 1,000. The number of deaths, however, registered, rose considerably in May, subsiding again in July; they rose from August to a maximum in November. The months of highest mortality were May, October, and November. With regard to the proportion of deaths among males and females at certain ages, this province differs from the North-Western Provinces, in that the excess of female over male deaths continues up to 40 instead of only to 30, and a slightly larger number of women over 60 years of age died than men. The district mortality was 26 (varying from 11 in Dera Ghazi Khan, to 42 in Delhi), and the town mortality was 33 per 1,000, varying from 16 in Dera Ghazi Khan, to 48 in Peshawar and Palwal in Gurgaon. In cantonments, including hill sanitaria, the death-rate was 15 per 1,000.

The birth-rate of the Central Provinces for the year under review, 37·79 per 1,000, is considerably lower than that of the preceding year, 45·36 per 1,000, and the mean ratio of the previous five years, 42·13. The ratio of 1886 is indeed the lowest recorded since 1875. The fall is probably due to the unhealthiness of the preceding year, as well as to the somewhat unusually high death-rate of the year itself. The death-rate was 33·24, against 34·21 per 1,000 in 1885, and 31·73, the mean of the five years 1881–85. Taking the natural increase to the population since the last census into account, the birth-rate of 1886 would be 35·74 and the death-rate 31·44. In six of the 20 districts of the province the deaths exceeded the births, but for all districts together the births exceeded the deaths by 4·55 per 1,000. The birth-rates in the several districts varied from 29·56 in Burhanpur, to 45·18 in Saugor. The district

death-ratios varied between 25·53 in Sambalpur to 48·17 in Nimar. The rural mortality was 33·76, and the urban 27·71.

The total number of births registered in Berar fell from 112,781 to 98,229, or, in other words, from 42·9 per 1,000 to 37·3; but still the births exceeded the deaths by 1,683 for the province as a whole, though in two districts. Ellichpur and Akola, the deaths exceeded the births. This result is ascribed not to imperfect registration, but to "an unusual prevalence of malarial fevers in these districts, causing sterility as "well as death." The provincial birth-rate above given is the lowest recorded for the last eight years. Taking the natural increase to the population into consideration since 1881, when the census was last taken, an addition of 128,640 should be made to the population on which the births are calculated, and in such case the provincial birth-ratio would be 35·60. For districts the birth-rates varied from 33·4 per 1,000 in Wun, to 44·2 in Buldana. The rural birth-rate was 37·7, against 43·5, the average of the previous five years, while the town rate was 35·1, against 37·3, the quinquennial average. The excess of the rural over the urban rate is attributed by the Sanitary Commissioner to deficient registration in towns, and this is borne out by the variation which exists in the 34 individual town ratios given by him, namely, from 9·8 to 48·6, the former being evidently understated, and the latter excessive, probably overstated. There was an excess of 7 per cent. in male over female births.

The death-rate rose from 34·0 per 1,000 in the previous year to 36·7, chiefly due to the excessive number of deaths from fevers. Taking the natural increase to the population since 1881 into account, the death ratio would be 34·99. The mean death-rate of the preceding five years was 33·7 per 1,000. The deaths among males exceeded those among females by 10 per cent. In the several districts the mortality ratios varied from 33 in Wun to 39·6 in Ellichpur. The mortality among infants under one year of age was 274 per 1,000. Compared with the preceding year there were fewer deaths from cholera and small-pox, but more from fever and bowel complaints. The rural mortality was 37·0 and the urban 35·5: this excess of rural mortality is unusual, but is due to the great prevalence of malarial fevers in rural districts.

Owing to the disturbed political state of Lower Burma during the year 1886, the registration of vital statistics was much interfered with. The birth-rate is recorded as 22·57, against 25·51 in the preceding year, both ratios being evidently considerably understated. The district ratios varied between 10·10 in Toungoo and 39·26 in Sandoway. In all districts but one (Hanthawaddy, including Rangoon town) the births exceeded the deaths, amounting on the whole to a natural increase of population of 25,681. The males exceeded the female births by six per cent. The registration of deaths was even more imperfect, the provincial ratio having been 15·54 against 19·89 in the preceding year. The district ratios varied between 9·51 in Toungoo and 23·03 in Hanthawaddy, including Rangoon town. The male exceeded the female deaths by 26 per cent.

The area under registration in Assam remained the same as it was in the previous year, comprising a population of 4,526,959, according to the census of 1881. The birth-rate among these was 27·55 per 1,000, against 27·95 in 1885. The ratio varied in districts from 23·89 in Nowgong, to 36·51 in Goalpara. In all the districts of the Brahmaputra valley the deaths exceeded the births, whilst the reverse obtained in the two districts of the Surma valley and in the hill district. The male births exceeded the female by 9·84 per cent. The deaths exceeded the births in the province as a whole by 983, yielding a ratio of 27·77 per 1,000 of population, against 25·23, the mean of the previous five years. The mean population in the tea gardens of Assam amounts to 301,817; among these a birth-rate of 28·95 and a death-rate of 38·25 per 1,000 was recorded, but birth registration is said to be neglected. Cholera was very fatal among them, having given rise to 1,702 deaths. Commenting on the tea garden mortality the Sanitary Commissioner writes:—"On the whole, a mortality "of 38·25 per 1,000 reads very like the truth, and, although high, is not surprising, "for although the labouring classes have very few above middle age, and the children "are few and healthy, still their labour is one of frequent exposure to disease, causes "from which the population at large is exempt.

The total number of births registered in Madras Presidency amounted to 855,034, equivalent to 30·4 per 1,000 of population according to the census of 1881. This ratio, the highest on record, is 1 per 1,000 higher than that of the previous year, but both are probably under the truth. The district ratios varied from 17·8 in the Nilgiris, or 23·0 in Vizagapatam, to 42·0 in Chingleput. There are 54 municipal

towns in the Madras Presidency (excluding Madras), and in them the birth-rate varied from 5·2 to 49·5 showing, apparently, both errors of omission and of commission. The total deaths were 553,927, equivalent to 19·7 per 1,000, against 21·8 in the previous year, and 19·3, the average of the preceding five years. The district ratios varied from 15·4 in Coimbatore and Nellore, to 36·1 in Madras, or, excluding this, to 25·6 in Chingleput. In the 54 municipalities above referred to, the death-ratios varied from 6·7 to 33·6. These ratios must be taken as approximations: they are evidently, on the whole, understated. The average excess of male deaths over female deaths was 5 per cent., but it varied greatly in districts, namely from a diminution of 2 per cent., to an excess of 17·3 per cent. In all districts but one the births exceeded the deaths; male births were 4·8 per cent. in excess of female births.

The total number of births registered in Bombay Presidency was 581,553, equivalent to 35·34 per 1,000, the highest ratio yet recorded. The mean ratio of the preceding ten years was 25·22, which being evidently under the truth, shows that birth registration has made much progress in the recent years. The district ratios varied from 18·98 in the city of Bombay (or, excluding this special case), from 25·15 in Ratnagiri, to 45·60 in Dharwar. Except the city of Bombay, the births exceeded the deaths registered by 200,368 in the aggregate; for the whole Presidency. The male births exceeded the female in every district, averaging, on the whole, 9·06 per cent. There is a marked difference between the urban and rural birth-rates in this Presidency, these having been 26·56, and 36·64 respectively. Considerable variation, however, exists in the accuracy with which statistics are collected in towns, for, whilst the lowest is 6·09, the highest is 55·02. Taking the natural increase of the population into consideration since the census of 1881, and assuming the birth and death registration to be equally accurate (which, however, as shown below, is not probable), and that emigration does not affect the question, the birth-ratio would be 34·23. The deaths are evidently not registered with the same accuracy as the births. In all 381,185 deaths were recorded, equivalent to 23·17 per 1,000 of population, and this mean includes extremes of 12·43 and 29·71. The death-ratio of the preceding year was 28·78, and the mean of the previous decennium was 26·16. All these ratios are probably below the truth. The natural increase to the population above given is, therefore, probably too high. The male death-rate exceeded the female by 10·55 per cent. Of the total number of deaths recorded 92,251 were among infants under one year of age, or 24·2 per cent. of the total deaths, and 158·6 per 1,000 of those born. The district mortality was 22·79, and the urban 25·80. The death-rate, taking the natural increase of population into account, would be 22·43 per 1,000.

History of Chief Diseases.

Cholera.

The year 1886 was one of diminished cholera prevalence as compared with the three preceding years, for whilst 208,371 deaths were recorded throughout those parts of India in which death registration is effected, the corresponding figures for 1885, 1884, and 1883, were 385,928, 287,609 and 248,860 respectively. The following table shows the numbers contributed by each province towards the total number of deaths:—

Annual Deaths from Cholera in India, 1877 *to* 1886.

Province.	Population.	Deaths from Cholera.									
		1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Bengal* - -	66,163,884	155,305	95,192	136,363	39,643	79,180	182,352	90,439	134,421	173,767	118,368
Assam - -	4,526,959	11,377	6,732	17,415	2,803	5,010	21,055	14,908	22,276	7,753	20,138
North-Western Provinces and Oudh - -	44,107,869	31,770	22,221	35,892	71,546	25,865	89,372	18,160	30,143	63,457	34,565
Punjab - -	18,842,264	29	215	26,135	274	5,207	39	190	614	1,936	12
Central Provinces	8,817,185	3,418	40,985	27,575	330	9,140	11,932	16,235	149	21,868	16,679
Berar - -	2,630,018	842	34,306	223	1	3,404	3,573	27,897	87	3,683	976
Rajputana - -	†	60	2,393	918	—	197	1,327	797	1,297	1,695	173
Central India -	†	926	8,047	2,734	299	581	1,562	1,740	1,018	4,624	290
Bombay - -	16,454,414	57,228	46,743	6,937	684	16,694	7,904	37,954	13,804	37,287	167
Hyderabad -	†	7,414	6,696	6	—	1,721	150	1,947	2,479	1,387	499
Madras - -	28,043,538‡	357,430	47,167	13,296	613	9,446	23,604	36,284	75,476	58,109	12,417
Mysore - -	4,092,648	2,902	723	14	25	25	893	124	330	2,677	10
Coorg - -	178,302	§	49	—	—	3	31	—	—	—	—
Lower Burma -	3,653,629	7,276	6,759	1,828	2,628	5,239	7,177	2,185	5,515	7,685	4,027

* Excluding Calcutta. † Population not known. ‡ Excluding Europeans and Eurasians.
§ Statistics not available.

It is thus seen that, compared with the previous year, Assam is the only province which recorded a larger number of deaths in 1886 than in 1885; in Bengal, North-Western Provinces, Bombay, and Madras the reductions are very considerable, ranging from a reduction of 55,399 in Bengal to 28,892 in North-Western Provinces. In the province of Assam, which alone recorded a higher aggregate number of deaths than in 1885, the excess was 12,435.

The last columns of the next table, however, give a better idea of the incidence of the disease among the people of the several provinces compared with the previous year, inasmuch as the ratios of death to population are given for each year. A comparison of these ratios shows that, taking the population into account, Bombay, Madras, Burma, and Bengal shared most largely in the lessened prevalence of the disease.

Statement showing the deaths from Cholera registered in the different Provinces by months during the year 1886.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of Deaths per 1,000 of Population. 1886.	1885.
Bengal - - -	9,800	6,172	8,755	18,056	9,716	3,585	4,542	5,234	4,186	8,054	16,090	24,178	118,368	1·78	2·62
Assam - - -	900	632	1,247	2,219	2,954	2,940	1,335	548	540	1,256	2,503	3,114	20,188	4·47	1·71
North-Western Provinces and Oudh.	391	51	33	571	1,016	1,676	1,256	4,761	5,650	9,575	5,503	4,082	34,565	0·78	1·44
Punjab - - -	—	—	—	1	4	2	1	1	1	—	1	1	12	0·0006	0·10
Central Provinces - -	35	26	298	747	6,198	3,768	3,068	1,752	347	231	131	78	16,679	1·89	2·48
Berar - - -	20	4	59	159	71	8	77	476	86	16	—	—	976	0·4	1·4
Lower Burma - -	292	186	131	196	159	216	499	515	543	432	394	464	4,027	1·10	2·10
Madras Presidency -	1,224	554	582	1,219	1,597	1,214	1,564	774	640	1,111	1,003	935	12,417	0·4	2·0
Bombay Presidency -	83	2	1	1	5	2	8	11	28	16	3	7	167	0·01	2·27
Mysore - - -	—	2	1	—	—	—	—	5	—	—	2	—	10	0·00	0·65
Coorg - - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total - -	12,745	7,629	11,107	23,169	21,720	13,411	12,350	14,077	12,021	20,691	25,630	32,859	207,409		

This table, however, is designed to show the seasonal incidence of the disease. In December of the previous year the number of deaths began to diminish, and the fall continued until March of the year under review, when the numbers rose again rapidly to a high figure in April. Thereafter it declined until October, when another resuscitation of the disease occurred, and deaths on the whole increased, reaching a maximum in December.

In the following table some of the more important data furnished by local Governments are brought together for comparison.

Province.	Mortality in 1886.	Average mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in rural circles.	Maximum mortality in towns.	Month of maximum prevalence.
Bengal - -	1·78	1·99	4·12	1·70	9·33	4·45	25·13	December.
Assam - -	4·47	3·14	7·34	4·39	16·7	10·14	38·66	December.
N.-W. Provinces and Oudh - -	0·78	1·02	0·85	0·78	3·9	5·49	22·26	October.
Punjab - -	0·00	0·08	0·00	0·00	—	0·00	0·08	May.
Central Provinces -	1·89	1·39	0·60	2·01	6·5	8·71	16·19	May.
Berar - -	0·4	2·9	0·03	0·4	1·8	2·00	1·10	August.
Lower Burmah -	1·10	1·52	1·57	1·04	6·34	3·29	23·34	September.
Madras - -	0·4	1·4	0·4	0·4	2·85	3·9	8·2	May.
Bombay - -	0·01	1·38	0·01	0·01	0·09	0·09	0·08	January.

This table shows that Assam suffered by far the heaviest mortality, and it, together with the Central Provinces, are the only two provinces which suffered a greater mortality in 1886 than the mean of the previous five years. In most provinces, as usual, the urban population suffered a greater proportion of mortality than the rural, in the Central Provinces and Berar alone this being reversed. The disease, as estimated

by the proportion of villages recording deaths, was most widely distributed in Assam, next in Bengal, while the Central Provinces and Lower Burma record an equal distribution. In the Punjab and the Bombay Presidency the ratios are inappreciable. The highest district ratios were recorded in Assam and the Central Provinces, the lowest in Bombay and Punjab. The highest town mortality recorded anywhere in India was also in Assam; but in Bengal, Lower Burma, North-Western Provinces and Oudh very high ratios are also recorded.

After the severe outburst of the disease in the preceding year Bengal shows a largely reduced mortality in 1886. The total number of deaths due this disease was 118,368 or 1·78 per 1,000 of population against 173,767 or 2·62 per 1,000 in 1885. The death ratio of 1886 was smaller than the last decennial average, which was 1·93 per 1,000. The reduced mortality was not, however, as might have been expected, equally distributed over the province, three of the eight divisions having suffered a higher mortality than the average of the previous five years, and one division (Dacca) having recorded a higher ratio than that of 1885. Of the six divisions showing a diminished mortality, the Bhagalpur Division shared the most largely in it. The Orissa Division, which usually suffers more than any other, again showed the largest mortality (4·24) exceeding slightly the five years' average (4·00), though below the record of the previous year, which was 5·14 per 1,000. The highest district ratio was 7·33 in the suburbs of Calcutta, and this is in accordance with previous experience. Next to it the Nuddea, Jessore, Furreedpore, Puri, and Balasore districts come with rates between 4 and 5 per 1,000, and in 19 of the 45 districts of the province the rate was below 1 per 1,000. The disease attacked 9·33 per cent. of villages, against 12·61 in the previous year. There was a considerable difference between the urban and rural mortality from this disease, being 4·12 in towns against 1·70 in districts. The highest town mortality was recorded in Puri, 25·13, but this is the site of an important fair at which large numbers of people congregate for a time. In two other towns the ratio exceeded 10 per 1,000.

The year was one of great epidemic prevalence of the disease in Assam. In all, 20,188 deaths were due to this cause against 7,753 in the preceding year, equivalent to a ratio of 4·47 per 1,000 of population in 1886, against 1·71 in 1885, and 3·14, the mean of the five years 1881-85. The brunt of the epidemic fell upon the districts of the Brahmaputra Valley, where the mortality was 7·13 (against 1·53 in 1885, and 3·76 in 1881-85), whilst in the Surma Valley it was 1·90 (against 1·89 in 1885, and 2·54, the mean of 1881-85). The quinquennial average was exceeded in every district of the Assam Valley, but Kamrup, Nowgong, and Darrang suffered the most heavily. In the province as a whole about 16·7 per cent. of villages recorded deaths from this cause against 11·5 in the previous year, but this ratio varied greatly in the several districts. The town mortality was 7·34 per 1,000, and the district mortality 4·39. The town mortality varied between the enormously high ratio of 38·66 per 1,000 in North Lakhimpur to 0·76 in Sylhet. In the towns of the Brahmaputra Valley the ratio was 10·33, and in those of the Surma Valley 2·75. The seasonal manifestations of the disease presented no unusual features.

The year was one of increased immigration, 18,059 coolies having entered Assam by the Dhubri route against 15,568 in 1885. Nevertheless the health of these people continued to improve upon the favourable results recorded in the preceding year. The Commissioner of the Assam Valley Districts in his report writes :—"The immunity of "the depôts at Dhubri from cholera in the first half of 1886, when the disease raged in "an epidemic manner in Bengal and Assam, is almost miraculous." The total death-rate at Dhubri fell from 0·22 in 1885 to 0·18 per cent., whilst the mortality from Dhubri up the river fell from 0·15 in 1885 and 0·26 in 1884 to 0·07 in 1886. On their way to Dhubri only one death occured amongst these coolies (0·005 per cent.) against 10 in 1885. At Dhubri 33 deaths in all took place, equivalent to 0·18 per cent., and of these 24 were due to cholera, all of them occurring in the latter part of the year. (The season extends from 1st December to 30th April.) There were in all 37 cases of cholera, and of these 5 arrived with the disease, 11 were admitted into hospital within 24 hours of arrival, 9 within 48 hours, and 12 after 48 hours. On the river trip from Dhubri to their destinations, 14 deaths occurred (0·07 per cent., against 0·15 in 1885) 9 of which were due to cholera. The actual number of coolies who embarked at Dhubri was 17,934, and these were carried in 239 trips, the larger boats carrying from 282 to 235 adults, and the smaller boats from 158 to 132 in the cold and hot months respectively. The business was so carefully and regularly conducted that no delay or blocking of immigrants at Dhubri occurred. The average duration of the trips was 5 days and 9 hours (varying from 4 days 17 hours to 5 days 17 hours).

By the Goalundo route 984 embarked, against 2,543 in 1885, and of these 3 against 7 died, two of the deaths having occured between Goalundo and Dhubri.

The disease was about one-half as fatal in the North-Western Provinces in the year under review as in the previous year. The total number of deaths recorded was 34,565 or 0·78 per 1,000 of population, against 1·44 in 1885, and 1·02, the mean of the five years 1881–85. The disease was not so widely distributed as in the previous year, 3·9 per cent. of villages having recorded deaths against 6·4. The Rohilkhand Division suffered the most severely in proportion to its population, the approximate average death-ratio there having been 1·80 per 1,000. The next most severely visited divisions were the Benares (1·30 per 1,000), the Lucknow (1·09), and the Sitapur (1·07) Divisions. The Jhansi Division escaped without a single death from this cause, and the large Meerut Division was almost equally fortunate, having recorded only 25 deaths in five of its six districts. Of the 49 districts in this province, 12 recorded death-rates below 0·01. In the Fyzabad and Rae Bareli Divisions, which in the preceding year recorded death-rates of nearly 4 per 1,000, the disease was comparatively quiescent, their ratios having been approximately 0·64 and 0·83 respectively. The highest district ratio was that of Bareilly in Rohilkhand, namely, 5·32. The Sanitary Commissioner observes that in the two contiguous districts of Bareilly and Shahjahanpur, more than one quarter of the whole provincial mortality occurred. Of the 106 towns furnishing statistics 46 returned deaths from this cause, and in 19 of these only one to two deaths each. On the other hand, 9 towns recorded over 100 deaths each, and of these the city of Bareilly stood first, with 458 deaths, equivalent to 4·44 per 1,000 of its inhabitants. The highest proportion of deaths was recorded in the town of Sandila (in the Hardoi District) where the high ratio of 22·26 per 1,000 was recorded; and although, writing of this town, the Sanitary Commissioner says, "any one who has visited Sandila cannot fail to have been struck with its generally well-cared for appearance," it is built upon "the accumulation for centuries of building *debris*, and in spite of its appearance of cleanliness the sanitary defects of Sandila are many and serious."

The year was one of singular freedom from the disease in the Punjab, only 12 deaths having been recorded from it during the year, against 1,936 in 1885, and these 12 deaths were scattered over 7 districts, yielding a ratio of 0·0006 against 0·08, the average of the preceding five years, and 0·10 in 1885. Even of this small number of reported deaths the Sanitary Commissioner writes that after investigation 3 only were found to be unmistakeable cases, and 6 certainly not cholera. In no previous year was so low a number of deaths recorded, though the years 1877 and 1882 approach it, the numbers for these years having been 29 and 39 respectively.

Cholera was still very prevalent in the Central Provinces; although less so than in the previous year, which was one of great prevalence. The total number of deaths due to this cause was 16,679, or 1·89 per 1,000 against 2·48 in the preceding year, and 1·39, the mean of the previous five years. The disease was not so widely diffused as in 1885, 6·5 per cent. of villages having returned deaths against 7·6. The mortality in towns was considerably less than in districts, having been 0·6 per 1,000, against 2·0 per 1,000 in rural circles. The Raipur District, again, as in 1885, suffered severely, every circle and 24 per cent. of villages having been attacked. The following table shows the approximate death-rates in the several divisions of the province for the year and the previous five years:—

	1886.	1881–85.
Vindhyan Division - - - -	0·00	1·40
Nerbudda „ - - -	0·59	1·18
Satpura „ - - - -	0·60	1·36
Wainganga „ - - -	0·55	1·60
Mahanadi „ - - - -	4·80	1·36

This table shows that all divisions except the Mahandi suffered a smaller mortality than usual, but in the last-mentioned division the incidence of the disease was severe (4·80), especially, as already stated, in the district of Raipur in that division. Here 21·7 per cent. of villages recorded deaths. The same division was conspicuous in 1885 by its high cholera mortality, which was 4·99. Comparing the mortalities of each of the 20 districts of the province with the average mortality of the previous five years, it appears that 14 recorded lower rates in the year under review. The highest mortality recorded in any town was 16·19 per 1,000 in Mungeli of the Bilaspur District. Deaths from this cause began to increase rapidly in March, reaching a maximum in May.

Thereafter they declined slowly during June, July, and August, and more rapidly during the last months of the year. In December 78 deaths only were recorded throughout the province.

The epidemic which prevailed in Berar during 1885 subsided during the year under review. The total number of deaths due to this disease was 976, equivalent to 0·4 per 1,000 of population, against 3,683 or 1·4 per 1,000 during the previous year. Nearly one half of this mortality occurred during the month of August, while the last two months of the year were without a single death. In addition to the exacerbation during August there was a minor recrudescence of the disease in April. There were in all 2,055 cases of the disease reported, with 976 deaths, equivalent to 47·49 per cent. of attacks against 43·2 per cent. in the preceding year. This ratio varied from 14·29 in Buldana to 50 in Basim. With reference to this diminished prevalence of cholera during an otherwise unhealthy year, the Sanitary Commissioner writes:—"Thus the "year itself was an unhealthy one; the rainfall was over the average; the mean "maximum temperature and mean range were higher than in the previous year; yet, "though cholera was present, it prevailed in less intensity than in 1885, notwithstanding "that the conditions appeared more favourable for its continued prevalence in increased "epidemic intensity." The distribution of the disease over the province was most unequal, Wun suffering out of all proportion to the other five districts. Indeed it may be said that the epidemic of the province was an epidemic in the Wun District, where 813 (equivalent to 2·0 per 1,000 of population) of the total 976 deaths were recorded, the other districts suffering a mortality not amounting to epidemic intensity. This is not by any means usual, for in the years of greatest epidemic prevalence since 1868 the Wun District suffered much less than other districts; the mean number of deaths recorded annually in this district for the 18 years previous to 1886 was 808, whilst the highest mean occurred in Akola (1,468), and the lowest in Ellichpur (681). Throughout the province as a whole, only 1·8 per cent. of villages recorded deaths from this cause, against 7·0 per cent. in 1885, and even in Wun this percentage was only 6·3. It is an extraordinary fact also in considering the distribution in space of this disease in a province like that of Berar, notable for the violence of its epidemics in some years and remarkable quiescence in others, that in a year in which the usual conditions for epidemic outburst existed, numerous sporadic cases occurred not followed by outbursts. Thus the disease appeared in 27 circles of the province, but in 10 of these only single villages of the circle were visited with mortality, the average number of villages in each circle being nearly 100, and two of these 10 occurred in the Wun District. With regard to the seasonal manifestation of the disease the history of the present year's epidemic differs from the usual course only in the delayed appearance of the disease in intensity after the rains set in. As a rule the disease, whenever it does appear epidemically, commences to show activity with the first onset of the rains, but in 1886 the commencement was delayed until July. It reached its highest intensity however as usual in August.

The epidemic of cholera which visited Lower Burma during 1885 subsided considerably during the year under review. The total death-rate was 1·10 per 1,000 against 2·10 in the preceding year, and 1·52, the average of the previous five years. Two districts only remained entirely free from attack, and the remaining 14 districts recorded death-rates varying from 0·01 (Amherst and Pegu) to 3·16 (Henzada). The districts of the Irrawaddy Division alone suffered to any epidemic degree, the average death-rate of its four districts being 2·37 per 1,000. For the province as a whole, 6·34 per cent. of villages recorded deaths from this disease; but in the Irrawaddy Division the percentage was 13·8, whilst in the Henzada District, where the highest proportion of deaths took place, the number of villages attacked was 19·5 per cent. Little difference is exhibited in this province between the urban and rural mortalities from cholera; in towns it was 1·57, and in rural circles 1·04 per 1,000. The highest town mortality recorded was 23·34 per 1,000 in Paungde in the Prome District.

As was anticipated in the report for 1885 from the declining deaths towards the end of that year, the year under report in Madras Presidency, was one of considerable freedom from cholera. The disease gave rise to 12,417 deaths against 58,109 in the previous year, or a ratio of 0·4 per 1,000 against 1·4, the average of the preceding five years. Cholera was therefore much less prevalent than usual. In eight of the 22 districts of Madras no deaths from this cause were registered, and in eight others only from one to 30 deaths were registered. In only six districts, therefore, were the deaths at all numerous. Five of these, viz., Ganjam, Vizagapatam, Godavari, Kistna, and Nellore, are situated in the north-eastern coast of the Presidency, the sixth, Malabar, being on the western coast. Among the districts recording no deaths are Madura and Tinnevelly, where the disease is usually very prevalent, their average

death ratios for the preceding five years having been 2·1 and 3·6 per 1000, while among the eight districts showing only a few sporadic cases is Tanjore whose quinquennial average mortality from this cause was 4·2, the highest average ratio of any district. Of the six districts in which the disease may be said to have prevailed epidemically, Godavari suffered most, with a mortality ratio of 3·9 against a quinquennial mean of only 0·7. In the Presidency as a whole only 2·85 per cent. of villages were attacked, against 14·2 in the previous year; but in the districts of Godavari and Kistna, where deaths were most frequent, the percentages were 27·74 and 15·07 respectively.

The rural and urban mortality was the same, namely 0·4 per 1,000. The highest mortality recorded in any single town was 8·2 in the Godavari district. At the commencement of the year the number of deaths reported in January considerably exceeded those from October to December 1885; but in February and March the numbers declined, to rise again from April to July. August and September were again months of comparatively few deaths, and a fresh impulse was given to the disease in October, which, however, happily showed signs of diminution in the last month of the year.

In Bombay Presidency cholera was remarkably little prevalent during 1886, the total number of deaths from it amounting only to 167 against 37,287 in the preceding year, and 83 of these occurred in January as the last traces of the epedemic of the previous year. In February only two deaths occurred throughout the Presidency. A smaller death tribute to this disease occurred once only in the preceding 21 years, when in 1874 only 37 deaths were recorded These years of extraordinary abeyance of the disease would seem to indicate that the *materies morbi* of the disease, whatever this may be, must be one of considerable powers of latency whenever such powers are called upon for exercise, for, as the Sanitary Commissioner remarks, "the lessened prevalence "of cholera during 1886 was certainly not due to any diminution of filth in and around "the villages and towns in the Presidency, and the only way to account for it is by the "supposition that the factor necessary for its development (probably atmospheric) "was absent." The disease broke out in 15 rural and 5 town circles. In the 15 rural circles were included 2,234 villages, and of these only 28 villages were visited or 1·2 per cent. The greatest number of deaths which occurred in any single circle was 40 in 5 of 237 villages, and the greatest number of deaths in any town circle was 17 in the large city of Bombay, with 773,196 inhabitants according to the census of 1881.

The circumstances attending the outbreak of cholera among the troops and jails are stated briefly in the ensuing paragraphs, following the procedure adopted in former reports for many years. These remarks are collected from the reports submitted by the medical officers who attend the several outbreaks.

The reports contain no striking instances or evidence of antecedent adverse circumstances to account for attack. Among European troops a case which terminated fatally in Calcutta was contracted or commenced while the man, a military prisoner, was *en route* by rail from Shahjahanpur to Calcutta. He had halted some hours in Allahabad, where the disease was prevalent. No other case occurred among the troops in Fort William. In the case of a man who was attacked in Chunar, it is stated that he had eaten largely of unripe plums. One man at Cawnpore who was attacked was a patient in hospital under treatment for a fractured arm. In Jhansi, also, a patient in hospital suffering from some other disease was attacked. Among Native troops two instances are given of over-indulgence in food prior to attack. The men who were attacked at Gauhati had marched from Kohima without tents, and had therefore been much exposed; they also experienced bad weather, and their food and water were often not of the best. It should be noted, however, that they had halted some time at Gauhati, where the disease prevailed. Among jails, two cases are mentioned in which the prisoners had been exposed to the fatigues of a long journey—one of a man who had previously indulged in a heavy meal of *dhai*; and two in which the men were patients in hospital under treatment for other diseases.

Of the 20 communities which suffered from this disease among European troops, diarrhœa was stated not to have been prevalent in eight. In three no report was made; in five it prevailed slightly; in three to some extent, and in one only considerably. For Native troops we have reports of 11 attacked communities, in seven of which diarrhœa was stated not to have been prevalent. In two it was greatly prevalent, and in two others to some considerable extent. In the Gauhati community, where 24 cases occurred, it was very slightly prevalent. In the Mudhapur community, where 11 cases occurred in two days, diarrhœa was not prevalent. Among jails there were 32 attacked communities; in 10 diarrhœa was not prevalent; in 12 it was slightly so; in seven it was somewhat prevalent, and in three it was greatly prevalent.

In the case of European troops we have complete data in respect of 18 communities, which occupied 557 buildings, from 28 of which cases were recorded, or 5 per cent. In Dinapore, of the five buildings occupied by a detachment of the 2nd Battalion, Derbyshire Regiment, among whom 9 cases occurred, four buildings were concerned. At Shahjahanpur 10 buildings were occupied by the 2nd Scottish Rifles, four of which contributed 9 cases. Among Native troops in three communities the disease appeared while they were in camp. Of stationed troops we have complete data in the case of seven attacked communities. These occupied 483 buildings, 16 of which furnished cases, or 3·3 per cent. At Ajmere, where 8 cases occurred, each case came from a separate building. For jails we have data in the case of 28 communities, which occupied 412 buildings, 63 of which furnished cases, or 15·2 per cent. It is of course usual to find this proportion higher in the case of jails than among troops, as, for obvious reasons, a smaller number of large houses in a confined area is necessary. In the Tipperah Jail 24 cases occurred from five of 16 buildings, and in Henzada 39 cases from five of eight buildings.

There is nothing special to record under atmospheric and telluric conditions attending outbreaks. As usual we have the weather reported to be "unusually cold," damp, rainy, great variations of temperature, strong winds, peculiar stillness of air, deficient or excessive rain, seasonable abnormalities, &c.

In the case of European troops we have complete data on this point in 18 communities. Among these, 41 cases of cholera were treated, and 161 persons attended on them, of whom one contracted the disease. He was a sweeper, and one of seven who attended upon 9 sick men. He was attacked seven days after attendance on the first case, and died. The medical officer writes:—"I am of opinion "that this death was the result of attendance on cholera cases." For Native troops we have complete information in the case of eight attacked communities. Among these there were 25 cases treated, with 82 attendants upon them, and none of these were attacked. At Gauhati, where the greatest number of cases occurred, namely 24, "about" 40 are said to have attended on them, and one of these was attacked. He had been in attendance on a child, raising it on his arms and feeding it. At Ajmere "about" 25 men attended on 8 cases, but none of them were attacked. At Shwebo 1 case occurred among the troops, but the total number of attendants who came in contact with him is not given, though one of them contracted the disease For jails we have complete information for 26 communities, among whom 100 cases occurred, and 323 attended on them. Of these latter, 9 were attacked. At Tipperah, where 73 attended on 24 sick, 5 were attacked; two after they had ceased to attend for five and eight days; a third first got dysentery after he ceased attending, and having suffered from this five days, contracted cholera; the remaining two were on guard duty at the cholera camp, and these got the disease 5 and 16 days after commencing this guard duty. At Dacca one of 13 attendants on 3 sick was attacked: a sweeper, 19 days after the last case. The medical officer writes of this case:—"The incubatory stage "of cholera being presumed to be from 10—14 days only, I think it extremely "doubtful that the attack was due to such attendance." At Bhagalpur of 13 attendants on 10 cases, 2 were attacked: these had been on cholera duty from the commencement of the outbreak, which lasted from 23rd to 26th November. One was attacked 35 hours after the first case; he had been employed as a hospital attendant for two months. The second was attacked 69 hours after the first case; he was previously employed in drawing water, and had been sleeping in No. 1 barrack where 1 other case occurred. No mehters were attacked. At Bareilly there were 6 attendants on 4 cases, and 1 was attacked, namely, the senior hospital assistant. No sweepers were attacked. The results are all brought together in the following table, which has been given in similar form for past years:—

Communities.	Number of cases of Cholera treated.	Medical Officers, Hospital Assistants, and other Attendants on Cholera Cases.		Per-centages of Attendants attacked.
		Number.	Number of these attacked with Cholera.	
European Troops	43	169	1	0·59
Native Troops	58	147	1	0·68
Jails	148	338	9	2·66
Total	249	654	11	1·68

None are noted in the case of British troops. With regard to Native troops it is noted of the Gauhati outbreak that the water-supply was drawn from a tank which had a bad reputation. Of the Rawalpindi outbreak it is noted that the accommodation was bad, the huts being old and out of repair, with floors below the ground level. At Loralai (Beluchistan), where one native trooper was attacked, it is reported that the tent which he occupied was kept very close and warm, and that on several occasions coolies were seen polluting the streams. Next with regard to jails—in 26 cases no insanitary conditions could be detected. At the Presidency Jail, Calcutta, it was noted that the supply of pure water being barely sufficient, tank water was used for cooking; overcrowding also existed in this jail throughout the year, and conservancy arrangements were not perfect. At Pubna the surroundings of the jail are said to have been defective. At Backergunge drainage was defective. At the Telikhal temporary jail, river water was used which was of suspicious character. At Gorakhpur the site of the jail is reported bad, being built on an old burial ground.

The reports again show that movement of affected bodies of men was attended in most cases with immediate cessation of the outbreak. Thus among European troops at Churnar, Lucknow, Bareilly, and Sialkot, after movement no other case occurred. At Dinapore the affected community was broken up into four parties which each moved independently into separate camps; in three of these no other cases occurred; but in the fourth another case occurred, when a fresh movement was made, and the disease disappeared. At Allahabad the affected community was broken up into two parties and moved into camp; only 1 other case occurred. At Shahjahanpur three parties were formed which went into camp; the first made three moves, during which they had 2 new cases; the second and third had no other cases after moving. At Yetagyo, 3 cases occurred after movement into camp, and then the disease ceased entirely. The reports from Native troops afford the following examples. At Fulta the community was broken up into two parties, which moved independently, and in neither did any other cases occur. At Gauhati the men were moved about; after the first move 2 cases occurred; after the second and third moves none; after the fourth 11 cases, and after the fifth 3, when the disease disappeared. In every other case in which moves were made, a single movement put an end to the outbreak. Among jails in three cases only were movements into camp made, in two of them (Backergunge and Toungoo) no cases occurred in camp, but in the third (Tipperah, where the outbreak was severe), although the community was broken up into three parties in two of which no other cases occurred, yet in the third 17 other cases occurred before the epidemic was stamped out.

Small-pox.

The total number of deaths recorded from small-pox throughout India was 51,097, showing a continued subsidence of the disease since 1884, a year of epidemicity, when this number was 332,904. The aggregate number of deaths for the year under report is the smallest on record since 1877.

Every province, with the exception of Punjab and Mysore, shared in the reduced mortality of the year under report over that of the previous year; but especially Coorg, Madras, Burma, and Assam. The largest number of deaths were recorded in the first months of the year, these months being the driest, whilst in the months of the monsoon prevalence deaths decreased in number, to begin to increase again in the last months with returning dryness of the air.

Fevers.

In the report for the previous year it was stated that fevers had been more fatal than usual, but in the year under review the deaths reported under this head were even more numerous. In 1886 there were 3,470,754 deaths against 3,396,239 in 1885. The increase, which amounted to 74,515 deaths, was contributed to by all provinces except Assam, Punjab, Burma, and Bombay. The most marked increase was recorded in the North-Western Provinces, namely, 92,468, followed by Bengal, and the most marked decrease was shown by Bombay (32,787).

Seven out of 10 provinces recorded higher proportionate mortality than the average of the previous five years, but for all provinces together the approximate mortality ratio of 1886 is almost identical with the approximate mean average of the previous five years. The North-Western Provinces and Oudh recorded the highest proportionate mortality (27·58 per 1,000 of population), and Lower Burma the smallest (7·79). For all provinces together approximately 74 per cent. of villages recorded deaths from this cause, but the provincial ratios vary from 58·3 in the Madras to 93·2 in the Bombay Presidency.

Bowel complaints.

The number of deaths recorded from bowel complaints fell from 293,638 in the previous year to 264,499 in the year under review. In the two previous years the numbers were in 1884, 274,234, and in 1883, 261,623. The numbers, therefore, do not vary much from year to year.

In seven provinces the ratios of death per 1,000 of population are lower than those of the preceding year, whilst in four only these were greater, and in all cases to a very small extent. The greater number of deaths were recorded during the wet months of the monsoon season.

Injuries.

In the report for 1885 attention was drawn to the increased number of deaths from these causes in that year, an increase shared in by all provinces with the single exception of Mysore. In the year under report a continued increase took place from 83,262 in 1885 to 87,469 in 1886. By far the greatest part of this increase was contributed to by the North-Western Provinces and Oudh (1,990), and Madras (1,444). The excess in the remaining provinces which record an excess, varies from 58 in Lower Burma to 625 in Punjab. The following four provinces, however, show a diminution over the figures of the previous year: Central Provinces (431), Mysore (84), Berar (72), and Coorg (7).

All other causes.

After deducting all the deaths caused by the foregoing causes, there remains a total of 924,182 due to all other causes. This number is smaller than the numbers of the two preceding years, and may, perhaps, be taken as an index of improving registration.

Vaccination.

The proportion of the population of India protected by vaccination during the year under report was almost the same as in the previous year. The approximate average proportion protected was 28·74 per 1,000, against 28·50 in the previous year. While the Provinces of Bengal, North-Western Provinces and Oudh, Punjab, Central Provinces and Lower Burma recorded higher proportions of the population protected in 1886 than in 1885, Berar, Madras, Bombay, and Coorg showed smaller ratios. The ratios of protection afforded in the several provinces varied from 14·05 in the North-Western Provinces and Oudh, to 46·33 in Coorg, or, omitting this small province, to 35·6 in Berar. With regard, next, to the proportion of the estimated births successfully vaccinated, the work of the year was again almost the same as in the previous year, the approximate percentage of these births vaccinated in India generally having been 29·25, against 29·55 in 1885. The slight diminution here shown was mainly due to lessened work in this direction having been done in Berar. The ratios of individual provinces varied from 9·1 in Burma, and 10·7 in Coorg and Madras, to 70·9 in Berar. The average number of vaccinations performed by each vaccinator varied from 726 in Bengal to 2,172 in the Punjab. On the whole the work done by each man was less than that of the previous year, only North-Western Provinces and Oudh, Central Provinces, and Lower Burma, showing better results this year than in the previous. The quality of work, however, was on the whole somewhat better, for whilst the approximate percentage of success in primary cases in India generally was 92·93 in 1885, it was 94·43 in the year under report. The results obtained in re-vaccinations also were, on the whole, better than those of the previous year, the approximate percentage for India as a whole having been 52·59, against 51·23 in 1885. The average cost of each successful vaccination varied from Rs. 0. 1. 7 in Bengal, to Rs. 0. 7. 11 in Lower Burma. The approximate average cost of each successful vaccination for all provinces combined was Rs. 0. 3. 9 against Rs. 0. 3. 11 in 1885.

The area of vaccination in Bengal was greatly extended during the year under report, embracing a population of 1,487,138 persons more than in the previous year, and requiring the services of 633 additional vaccinators. The total number of persons vaccinated was 1,522,176, against 1,284,174 in the previous year. Of the vaccinations performed, 1,515,491 were primary and 6,685 re-vaccinations, with success at the rates of 99·51 and 57·02 per cent. respectively. The former rate is too high to be accepted without reservation, the verifications of results by Superintendents yielding a percentage of 96·82. The operations performed by municipalities, dispensaries, &c., not included in the above (namely, 87,036 primary and 1,065 re-vaccinations) shows success at the rates of 94·75 and 64·32 per cent. in primary and re-vaccinations respectively. The number of children under one year of age successfully vaccinated

was 223,460, or about one-tenth of the infant population available. The average number of operations performed by each vaccinator was 726, against 878 in the previous year; and the cost of each successful vaccination was Rs. 0. 1. 7, against Rs. 0. 2. 0 in 1885–86. The results of animal vaccination in this province are on the whole reported upon unfavourably, the want of success attending many operations with stored bovine lymph depending evidently on imperfections in the method of storing, and adverse atmospheric conditions for such work in the hot moist climate of Lower Bengal. Continued attention is, however, being paid to the subject.

The average number of vaccinators employed throughout the year in the North-Western Provinces was 659, and these performed 713,916 operations in all. Of these 689,913 were primary, and 24,003 re-vaccinations, with successes at the rates of 92·80 and 28·08 per cent. respectively. Of the successful primary operations, 41·7 per cent. were on children under one year of age, and 42·1 per cent. among children over one year and under six years. The amount of work done in vaccinating infants under one year varied considerably in the several circles. In the first circle 61·7 per cent. of primary vaccinations were successful on children under one year, and 28·4 on those between one and six years. In the second circle these ratios were 34·0 and 46·7 per cent., and in the third circle 30·3 and 50·3 per cent. The number of infants available for vaccination at an estimated birth-rate of 40 per 1,000, and making allowances for deaths, amounted to 1,364,384, while the number of these successfully vaccinated was 287,819. The number of vaccinations performed by each vaccinator was, on an average, 1,083, against 1,053 in the preceding year, and the cost of each successful vaccination was as Rs. 0. 3. 1 against Rs. 0. 3. 6 in the previous year.

Whilst the supervising staff of the vaccination department in the Punjab was considerably weakened by the abolition of the post of one Deputy Sanitary Commissioner and the Native Deputy Superintendent of Vaccination, and by the temporary absence on military duty of the single remaining Deputy Sanitary Commissioner, the executive establishment was increased by one supervisor and 10 vaccinators. The gross outturn of work exceeded that of the previous year by 14,847 operations. This increase was due mainly to the increased efforts of the district establishment, and in a lesser degree to those of cantonment establishment. The total number of operations performed in the province was 621,240; of these, 598,028 were primary, and 23,212 re-vaccinations. The ratios of successes attained by the special establishment were 95·20 and 42·59 per cent. in primary and secondary vaccinations, whilst the corresponding ratios shown by dispensary establishments were 89·99 and 32·91 per cent. The number of available children under one year of age, calculated as explained above, was 608,379, and of these 439,365 were successfully vaccinated. The number of operations performed by each vaccinator was, on an average, 2,172, against 2,211 in the preceding year. The cost of each successful vaccination fell from Rs. 0. 2. 4 in the preceding year, to Rs. 0. 1. 11, owing chiefly to the reduction of the supervising establishment above referred to. A notable feature in the history of vaccination in this province was the impulse given to animal vaccination by the use of the buffalo calf in place of the heifer—a change which removed many of the objections urged against animal vaccination by Hindus, when the calf, a sacred animal, was used as a vaccinifer.

In the Central Provinces the number of vaccinators employed was increased by three as compared with the previous year. In all, 409,399 vaccinations were made in the province, of which, 385,497 were primary and 23,902 re-vaccinations. The great majority of these operations were done by the special establishment, with successes at the rates of 95·48 and 73·27 per cent. in primary and secondary vaccinations respectively, while the remaining operations done by the dispensary establishment were successful in 92·09 and 68·32 per cent. of cases. The number of available children under one year of age for vaccination was 343,817, and of these 167,797 were successfully vaccinated. The number of operations performed by each vaccinator was, on an average, 1,726 against 1,624 in the preceding year, and the cost of each successful vaccination was Rs. 0. 1. 11 against Rs. 0. 1. 11$\frac{3}{4}$.

The amount of work done in Berar was somewhat less than in the previous year. In all 94,172 vaccinations were performed, all but 48 being primary operations. The greater part of this work was done by the special establishment, with success in the case of primary operations at the rate of 96·2 per cent. The number of re-vaccinations was so small that the ratio of success, 19·4 per cent., conveys no accurate meaning. The proportion of success obtained by dispensary establishments in primary cases was 92·3 per cent. The small amount of re-vaccination work done is to be regretted,

but attention has been drawn to the subject, and better results may be looked for in future. The number of available infants for vaccination was 73,013, and of these 68,223 were successfully vaccinated, the highest proportionate amount recorded among all the provinces. Each vaccinator performed 2,070 operations on an average, and the cost of each succcessful vaccination was Rs. 0. 3. 3, against Rs. 0. 3. 1 in the preceding year.

It is satisfactory to observe that, notwithstanding the disturbed political state of Lower Burma, vaccination work did not suffer. The total number of operations performed exceeded that of the previous year, having been 65,669, of which 61,181 were primary, and 4,488 re-vaccinations. The greater number of these operations were, of course, done by the special establishment, with success at the rates of 87·90 and 53·67 per cent. respectively in primary and secondary operations. Corresponding ratios for the work of dispensaries, &c., were 74·78 and 59·09 per cent. The ratios of success in primary operations were not satisfactory. The estimated number of infants available for vaccination was 138,699, and of these 13,618 were successfully vaccinated. The number of operations performed by each vaccinator was, on an average, 1,003, and each successful operation cost Rs. 0. 7. 11, against Rs. 0. 9. 2 in the preceding year. The municipality of Bassein sought the protection of the Vaccination Act during the year under review.

The operative establishment of Assam was increased by five vaccinators. The total number of operations performed was 121,900, of which 121,329 were primary, and 571 re-vaccinations. The proportion of success attained was 92·32 and 79·86 per cent. respectively. The total number of estimated available infants was 161,533, and of these 21,638 were successfully vaccinated. On the whole, increased attention was paid to vaccination in this province, though in certain districts the work done was not so good as before. The compulsory Vaccination Act was in force in the municipalities of Gauhati, Sylhet, and Dibrugarh, but the provisions of the Act are not enforced with any vigour, and in consequence the amount of protection afforded was not great.

The amount of vaccination work done in the Madras Presidency was not so great as in the preceding year, although a greater number of vaccinators were employed, namely, 751 against 721 in 1885–86. In all 710,203 operations were performed, of which 697,248 were primary and 12,955 re-vaccinations. The amount of success obtained by the special establishment was 94·7 per cent. in the case of primary operations and 65·1 in re-vaccinations, whilst these ratios were 83·1 and 50·1 respectively, in the case of dispensary operations. The number of estimated available infants for vaccination was 1,101,114, and of these, 130,986 were successfully vaccinated. The average number of operations performed by each man of the special establishment was 904, and each successful operation cost Rs. 0. 4. 6, against Rs. 0. 4. 4 in the preceding year.

The Bombay operative establishment was increased by 7 vaccinators. In all, 900,474 operations were performed, of which 854,543 were primary, and 45,931 re-vaccinations. The success obtained by the special vaccination establishment was 95·56 per cent. in primary operations, and 65·47 per cent. in re-vaccinations, whilst these ratios for dispensary operations were 93·25 and 39·02 per cent. respectively. The work done by the special establishment was not so great as in the previous year, owing to the diminished number of re-vaccinations performed. The number of estimated infants available for vaccination was 932,370, and of these 559,618 were successfully vaccinated. Each vaccinator performed on an average 1,822 operations, against 1,854 in the preceding year. This diminished work was due to the smaller number of operations done by the Government, Municipal, and Local fund servants; the work done by each vaccinator in the Cantonments and Native States establishments was greater than in 1885–86. The cost of each successful vaccination was Rs. 0. 5. 5, the same as in the preceding year.

In all, 9,128 operations were performed in Coorg, of which 8,590 were primary, and 538 re-vaccinations. This was somewhat less than the number performed in the preceding year, and the diminution is accounted for partly to the absence of 2 vaccinators for a part of the year. The ratio of success obtained by the special establishment was 92·53 per cent. in primary vaccinations and 68·2 in re-vaccinations. The dispensary establishment at Mercara performed only 5 primary and 4 re-vaccinations. The number of estimated available infants was 6,389, and of these 763 were successfully vaccinated. Each vaccinator performed on an average 912 operations, against 1,506 in the preceding year. The cost of each successful vaccination was Rs. 0. 4. 2 against Rs. 0. 3. $4\frac{3}{4}$.

Sanitary Works—Military.

During the year 1886–87, a sum of Rs. 63,49,628-15-2 was expended on military sanitary works, as shown in the following details:—

	R.	a.	p.
Original works	29,92,259	2	1
Repairs	14,28,880	5	4
Establishment	14,29,933	10	7
Tools and plant	57,691	0	0
Barrack Department	5,47,946	12	7
Total	64,56,710	14	7

or, excluding from this the amount held in suspense, Rs. 93,348-8-1, and the amount expended in England, Rs. 13,733-7-4, the net outlay in India during the year was Rs. 63,49,628-15-2.

The details of some of the works executed or undertaken during the year, having for their object the health or comfort of the soldiers were as follows:—

Accommodation for Troops.—At Quetta.—An unusually heavy amount of work was executed during the year in this station.

(1.) Subsidiary buildings, comprising quarters for 13 families, band barrack, quarterguard, and cells, and store-room were completed for the 1st British infantry battalion.

(2.) Half-company hut barracks were completed for three-and-a-half companies of the 2nd British infantry battalion.

(3.) The drivers' barracks and the subsidiary buildings of the single men's barracks for the mountain battery were finished.

(4.) Three barracks similar to those provided for the mountain battery were completed for the garrison battery.

At Fyzabad, of the three new barracks for the Royal Artillery, two are practically built, and the third is nearly ready.

At Jhansi extra accommodation for British troops was being provided consequent on the rendition to Scindia of Morar and Gwalior.

At Nowgong, No. 13 double-storied barrack was finished towards the end of the year, and was in occupation by troops.

Accommodation for Officers.—In the Murree Hills out-houses for officers' quarters in the hutted camps were finished during the year. This was a long-felt want. All the out-houses for officers' quarters in the Murree Hills are now finished.

In the Chungla and Khyra Gullies the buildings, as originally constructed, were of a very temporary kind. An expenditure of Rs. 7,978 was incurred principally in replacing the rotten shingle roofs with sheet iron.

At Quetta the alterations to the old mountain battery barrack, mentioned in last year's report, were completed. Seven new blocks of quarters, to accommodate three junior officers each, were also nearly completed. These will provide quarters for three subaltern officers, Mountain battery, and 18 officers of the 1st British infantry battalion.

At Loralai quarters have been built for six field officers, two captains, and six subalterns of native cavalry and infantry. Quarters for four Royal Artillery officers, and the Royal Engineer officers of the Military Works Department, have also been completed.

Buildings for the Army Medical Department.—At Peshawar a railway rest-house was purchased at a cost of Rs. 6,000 for use as a hospital for women and children.

At Quetta four wards, containing 112 beds, of the Station Hospital, were completed. A ward for women and children and several subsidiary buildings have also been completed.

Improvements and Renewal of Buildings.—The works involved under this head consist of the reconstruction of old buildings or their remodelling, so as to eradicate some conspicuous defective feature. The substitution of permanent tile roofing for thatch and of pucca for katcha floors, where necessary, are items under this head. Repairs to buildings, the cost of which exceeds a quarter of their book value, have to be treated as debitable to original works. The principal expenditure on works of this class has been incurred at the stations of Peshawar, Muttra, and Jullunder.

The Chakrata water-supply scheme has been again taken up.

Civil Sanitary Works.

Notwithstanding an increase in the income of the Bengal municipalities, the proportion of expenditure on sanitary works was less than that of 1885, the ratio being 38·65 per cent. against 40·28, or, including roads, 56·62 against 56·88 in the previous year. This decrease affected several items, but it was chiefly under the head of water-supply that it was most conspicuous. Some of the important sanitary works which were in progress or were completed or undertaken during the year were as follows. Considerable extensions were carried out in the water-works at Darjeeling. A water-supply scheme was brought into use at Jamalpore and in Monghyr. The Bhagalpur water-works were in progress. A scheme for supplying the town of Puri with good drinking water has been submitted to Government for sanction. A malarious swamp to the east of the Hazaribagh Jail has been converted into a lake by prison labour. In the town of Pubna the water of the Ichamutti river was protected by means of embankments and bridges. In addition to these, various measures were adopted during the year to improve the water-supply in parts of the Burdwan, Jessore, Rajshahye, and Sonthal Pergunnas Districts. The embankment which protects the town of Nuddea from inundation was materially improved. Various improvements were effected in the drainage of Bettiah, Berhampore, Rungpore, and Darjeeling. In Naraingunge a cess-pool was filled up at a cost of Rs. 7,318. The drainage canal in the Purnea town, which was taken in hand in 1884, was completed in the year under review. The drainage works in Balasore town were progressing, and levels were being taken at Mozufferpore for a drainage scheme. In the Midnapore district, the Surpai drainage scheme was being proceeded with, and the excavation of a canal in the Cuttack district, which was commenced in the preceding year, was still progressing.

In the municipalities of the North-Western Provinces and Oudh, as a whole, a good deal of expenditure was incurred in carrying out conservancy arrangements, improving the water-supply and drainage, constructing or repairing roads, latrines, pavements, &c., &c. Of these the following may be specially noted. At Almorah an excellent water service and a public bathing tank were provided. At Naini Tal projects were in hand for improving the water-supply and flushing the upper bazar drains. At Moradabad Rs. 25,776 were spent chiefly on the construction and repair of drains and metalling of roads. At Sambhal Rs. 9,725 were expended on sanitation. The chief works were construction and repairs of pavements and drains and metalling of roads. At Bareilly Rs. 13,316 were spent for sanitary purposes, the main item being the drainage of the town. At Shahjahanpur Rs. 18,570 were expended on sanitary works, chiefly consisting of drains and latrines. At Dehra arrangements have been made for supplying the town with pure drinking water. At Mussoorie a comprehensive scheme was in progress for removing the sewage to some distance outside the station and burying it in trenches. At Saharanpur Rs. 41,471 were spent principally in constructing drains and a slaughter-house. At Meerut an outlay of Rs. 17,744 was incurred on sanitary works. At Aligarh Rs. 17,193 were spent for sanitary purposes. At Agra Rs. 43,867 were laid out on sanitary works, including expenditure on the artesian well operations. At Muttra and Banda Rs. 16,150 and Rs. 11,937 were expended respectively in carrying out various sanitary improvements. At Allahabad the large sum of Rs. 77,436 was spent on sanitary works, but no works have yet been taken in hand in connexion with the water-works. At Benares, Mirzapur, Ghazipur, Gorakhpur, Lucknow, Sitapur, Sandila, Rae-Bareli, Fyzabad, and Bahraich also, large sums were spent on sanitary improvements, but no works were undertaken deserving of special notice. There is little to record in regard to the progress of sanitation in rural circles. The local government has, however, called for information regarding drainage, water-supply, and domestic cleanliness of the villages, and the Sanitary Commissioner of the province suggests that a republication of the rules issued by Mr. McConaghey, while he was Collector of Banda, might be useful as a guide to other collectors who take a special interest in the sanitary condition of villages in this district.

Nothing seems to have been as yet done to improve the insanitary surroundings of the rural population of the Punjab. During his tour of inspection Dr. Stephen visited a few villages and pointed out to Lumberdars some glaring sanitary defects which required removal. But no information is given as to whether any measures were taken to remedy the defects. In the municipalities an aggregate of Rs. 10,08,503 was spent on sanitary improvements against Rs. 9,16,669 in the preceding year. And if the outlay on vaccination were added, the total expenditure on account of sanitation would amount to Rs. 10,28,997. It is to be noted, however, that although the amount spent on drainage (Rs. 1,19,955) was somewhat greater than in the previous year, the

expenditure on account of conservancy (Rs. 4,44,781), and vaccination (Rs. 20,494), was less, and as regards conservancy the proportion spent of total expenditure is below every other province of India except Burma. In 19 districts important sanitary works are stated to have been either under consideration, in progress, or completed. Among these, the works of greater magnitude were the Simla sewage scheme, the main line of which has been laid, the extra-mural drainage channel at Amritsar, the masonry drains at Anarkali, and the water-works at Rawal Pindi which have already made considerable progress. Schemes have also been sanctioned for the water-supply of Delhi and Peshawar.

No large works of a sanitary nature were undertaken during the year in the Central Provinces, though attention was paid to improvement in water-supply, drainage, and conservancy. With a view to improve the conservancy and water-supply of villages, certain rules were framed under the Land Revenue Act, but were applied only to selected areas. The results of the working of these rules during the year under review have been so encouraging that the Chief Commissioner has decided "to extend very "considerably the areas within which their active enforcement shall be attempted." Altogether 166 new wells were constructed, and 232 wells were repaired during the year in the various rural circles of the province. In the municipalities a total sum of Rs. 2,54,135 or 33·7 per cent. of income was expended on sanitation. Out of this Rs. 1,28,764 were appropriated to the Conservancy Department, Rs. 12,359 were spent on drainage, and Rs. 6,305 were contributed towards vaccination. Compared with the neighbouring province of Berar, the outlay on conservancy and drainage was small.

No sanitary work of any magnitude was undertaken during the year in Berar. The Kalapani and Pahora tanks in the Amraoti district, which were commenced respectively in 1882 and 1884, were completed during the year. In the municipalities, out of a total income of Rs. 1,66,333, the amount spent on conservancy was Rs. 36,003, on drainage Rs. 13,973, and on water supply Rs. 16,887. In the civil stations, non-municipal towns, and villages, Rs. 93,685 were spent on sanitary improvements. Of this sum 33·3 per cent. was laid out on conservancy, 16·2 on drainage, and 22·5 on water supply. It is to be regretted, however, that the total amount allotted to sanitary improvements in the districts, viz., Rs. 94,780, was not fully utilised. All the more so as the common excuse generally pleaded in justification of inactivity in the execution of sanitary reforms is want of funds. The sanitary condition of villages still continues in its primitive state, and the Sanitary Code, which was issued some time ago, has hitherto been almost a dead letter.

The record of sanitary work done in Assam is very meagre. The amount expended on sanitary works in 20 towns, unions, and municipalities, was Rs. 85,050, or Rs. 4,374 less than in the previous year, and this diminution is due to diminished expenditure on improved water supply, which the section shows to be the item most urgently calling for increased expenditure. Excluding the amount spent on roads, only Rs. 50,000 remained for sanitary works of all kinds. The only permanent sanitary work of any kind noted as nearly completed is the new water supply in Gauhati.

In Lower Burma some interest was evinced by the district officers in carrying out sanitary improvements outside municipal limits. In most of the districts some works were undertaken to improve the sources of water-supply and making or repairing of roads and culverts. Although the amounts contributed by the local funds for these purposes did not come up to a very large sum, yet it is gratifying to find that at length a beginning has been made with a view to extend the benefits of sanitation to the population of the rural tracts of the country.

Neither in the municipalities of Madras Presidency, nor in the districts outside municipal limits were works of any importance undertaken or executed during 1886; but various improvements of a minor nature were carried out, such as sinking of new tanks and wells or improving the existing ones, constructing and repairing of latrines, drains, dust-bins, markets, slaughter-houses, &c., and improving town and village sites. In the municipalities during 1885–86, of the sanctioned amount of Rs. 5,98,220, only Rs. 5,58,278 were spent, and in 1886–87 out of the sanctioned amount of Rs. 6,48,473, only Rs. 3,76,925 were expended in nine months up to end of December 1886. Again, in the local fund circles during 1885–86, out of Rs. 3,98,041 sanctioned for sanitary improvements, only Rs. 2,89,922 were spent, and in 1886–87 out of Rs. 3,64,601 only Rs 1,80,434 were expended up to end of December 1886. This apparent apathy or indifference on the part of the municipal and local fund boards in utilising to the fullest extent all available means for removing the insanitary condition of cities and villages is greatly to be regretted.

In the municipalities of Bombay Presidency Rs. 3,38,763 were spent on conservancy arrangements, and various sanitary improvements were carried out by constructing or repairing wells and other sources of water-supply, latrines, drains, roadways, slaughter-houses, &c. Out of these the following may be noted: At Broach Rs. 41,483 were expended in finishing and paving certain roads. At Surat Rs. 7,506 were spent in improving the Jedda Khari. At Ahmednagar a total sum of Rs. 24,852 was expended on sanitary works of various descriptions. In Ratnagiri Rs. 5,505 were expended in substituting iron pipes for rubble masonry channels for bringing water from the Nachana springs.

In the local fund circles also various sums were spent in improving water-supply and drainage, and the districts in which works of any importance were carried out, were as follows: In Ahmedabad Rs. 22,553 were expended on water works, and in Kaira and Broach, respectively, Rs. 25,695 and Rs. 19,649 were spent for the same purpose, and in Shikarpur also Rs. 29,271 were spent on water-supply.

The special committee's report on the draft Bill regarding village conservancy was under the consideration of Government, and good results are expected to follow its enactment.

There is very little to record under the head of civil sanitary works in Coorg. No improvements were carried out in the villages. In some of the municipalities, besides the outlay on conservancy establishments, Rs. 722-2-10 were spent during the year in purchasing dust-bins, and constructing or repairing slaughter-houses, drains, roads, &c.

A retrospect of this section of the report for past years shows that sanitary works of importance and even of magnitude have been from time to time accomplished in the various provinces, but progress has been on the whole desultory and fitful. That this has not been a result of indifference on the part of the sanitary authorities entrusted with the charge of the public health, is amply shown by the annual sanitary reports of the several provinces and the valuable memoranda of the Army Sanitary Commission upon these reports. The cause of much of the inaction displayed by local authorities on matters of sanitation has been due rather to want of funds and to the very inefficient means which have hitherto existed for giving effect to suggested improvements even of an obvious character. But since the establishment of local government boards, and since the development of the sources and methods of local taxation for local wants under recent legislation, means have been called into existence for enlightened executive action, and the Government of India has at length found itself in a position to impress upon the attention of all local governments the urgent necessity which exists for sanitary work on a well-considered plan to be pursued persistently and systematically until the end is reached. A definite policy of sanitary reform and development has been sketched out for them. It has been pointed out to them that the subject, immediately connected as it is with the suppression of preventable diseases from which so great mortality occurs in India every year, is one of the gravest interest to the Government of India; that the time has come when by a systematic survey, from a sanitary point of view, of towns and villages, a clear perception should be formed of what had to be done towards meeting the requirements of town and village sanitation. These requirements were stated to be broadly three in number, provision of pure water, drainage, and an effective conservancy system. Where these requirements can be met by the operation of laws already in force, it is simply a question of putting such laws into effective operation through the instrumentality of the local board and municipal committees, aided by the influence, and, when necessary, direct intervention of the administrative officers of Government. But where the existing laws are defective, the Government of India has recommended to local governments the business of so amending the laws as to make them suitable to the needs of the country. Finally, so far as financial considerations will permit, the Government of India has stated its readiness to consider proposals made for the concession of moderate grants in aid of local funds where this may be essential, and where it is apparent that the requirements of the case cannot be met from provincial or local resources.

In illustration of the preceding remarks the following passage is quoted from the orders issued to the Government of Madras under date September 24th, 1887, in regard to the sanitation of rural villages in that Presidency. Orders similar in tenor have issued to other Presidencies; and the same policy of ascertaining by professional surveys the wants of each locality, of preparing complete and well-considered plans for meeting these wants and of prosecuting these plans systematically from year to year as funds become available, has been also prescribed for municipalities in all the

provinces. It may be hoped that a foundation has thus been laid for systematic and continuous sanitary work, which will be free from the disadvantages of desultory and spasmodic action, and which in time must produce the best effects on the general health of the Indian population.

"The subject of improving the sanitary surroundings of the rural population of the province, immediately connected as it is with the suppression of preventable diseases from which so great mortality occurs in India every year, is one of the gravest interest to the Government of India; and the Governor-General in Council regrets to notice that so large a portion of the funds allotted in the budgets of the year under report to the head 'Sanitation' was allowed to lapse. After nearly a quarter of a century of professed village sanitary work, but little of practical utility has up to the present time been done for the maintenance of the health of the rural population, on whose working power the prosperity of the country mainly depends. No doubt this unsatisfactory result is mainly due, *first*, to the want of a clear perception of what should be done; and *secondly*, to the want of an efficient agency for doing it. In the opinion of His Excellency in Council, the time has come when, by a systematic village survey from a sanitary point of view, each provincial government should arrive at a clear perception as to the first point, and when by enforcing the sanitary provisions of the Local Boards Acts, or, where these provisions are inadequate for the purpose, by special legislation, effect should be given to the conclusions reached as to the requirements of village sanitation. These requirements are, broadly speaking, three in number, provision of pure water, drainage, and a simple conservancy system. It may not be possible to effect much in any single year in the directions indicated, but the time has come when a well-considered plan should be adopted, and pursued persistently and systematically, until the end is reached.

"The powers and responsibilities of local bodies in Madras in the matter of sanitation are defined by Madras Act V. of 1884. Each local board is empowered and required, subject to such rules as may from time to time be prescribed by the Governor in Council, and so far as the funds at their disposal may admit, to provide, among other matters, within the area of their authority, for the sanitation of towns and villages, the cleansing of the streets, tanks, and wells, and other works of a similar character, as well as for other measures of local public utility calculated to promote the safety, health, comfort, or convenience of the people. The taluk boards are authorised, under sections 99 and 100, to take measures to ensure that the supply of drinking water shall be kept pure, and, under section 101, to provide for the cleansing and draining of unwholesome buildings and lands. Finally, under section 141, the duties of *panchayats* are defined to be—

"(*I.*) *In all unions*—

"(*a.*) the cleansing of the village streets, drains, tanks, wells, and other places in the union, and

"(*b.*) generally doing such things as may be necessary for the preservation of public health.

"(*II.*) *In a major union*—

"(*a.*) making and repairing the village streets and drains in the union;

"(*b.*) constructing and repairing such tanks and wells and other works as will supply the inhabitants of the union with a sufficient supply of water for domestic use.

"*Panchayats* are further empowered, subject to the control of the taluk board, to exercise within their unions the powers conferred on the taluk board by sections 99 and 101 of the Act in respect of closing and cleansing wells, and cleansing and draining buildings and land.

"The powers conferred by these legal provisions on the Madras district authorities are very considerable, and, if systematically exercised, cannot fail to be productive of great good to the people. It is possible that the powers conferred are commensurate with the wants of the situation in Madras, but if His Excellency in Council is of a different opinion, it will be for him to consider whether a further recourse to legislation should not be had. In Bombay it has been found necessary to undertake legislation in order to confer on village police officers, and on magistrates, certain additional powers to enforce sanitary measures in rural villages. The Government of India must look to the Governor in Council to prescribe, after due consideration and inquiry, the action which the local boards should take in furtherance of the provision of a pure water supply, a system of drainage (where necessary), and of conservancy for every village, and then to enforce that action through the influence and, when

necessary, active intervention of the local officers. In this connexion I am to add that the Government of India will be prepared to consider any proposals which the Governor in Council may make for the concession of a moderate grant in aid of local funds where this may be absolutely essential, and where it is apparent that the requirements of the case cannot be met from local and provincial resources."

General Remarks.

Health of Haj pilgrims during 1886.

The number of pilgrims who attended the Haj of 1886 was not so great as that of the preceding year, when the Haj (Haj Akbar) was of more than ordinary importance; but it was estimated that about 80,000 pilgrims were present on the plains of Arafat, and this number is unusually large for an ordinary Haj. Among those present, a larger number of paupers were included than in any of the three preceding years. Nothwithstanding this, it is satisfactory to note that for the third consecutive year no cholera or other epidemic disease prevailed among them. The health of the pilgrims is described as on the whole good. Muna, which has hitherto usually been described as a most dirty place, was remarkably clean, and, for the first time, a good water-supply was made available to the pilgrims by the generosity of the Nawab of Rampur, who constructed a large reservoir, fed by a branch of the Zobeida aqueduct. The water from this reservoir was drawn from stop-cocks, and means taken to prevent the pollution of the stored water. The reservoir, however, is not large enough to supply water to all present, and it is reported that at least two others would be necessary for all requirements. Jedda and Mecca were also kept constantly swept and clean during the Haj season. The dry and sandy nature of the country is specially favourable for conservancy arrangements, and, when a little care is taken, as was done in the year under report, many nuisances and disease-producing conditions can be avoided. Unusual care was also taken to protect the water in the reservoirs along the Zobeida aqueduct. Guards were placed over them to prevent the people from polluting them; and although much was done, yet stronger guards, it is reported, might effectually have prevented all contamination. The health of the Indian pilgrims during their voyage from India to the Hedjaz was, on the whole, fair and satisfactory.

Bills of health for vessels.

In the twenty-first Annual Report of the Sanitary Commissioner with the Government of India it was noted that a revised form of bill of health was introduced on the 31st July 1885, based on the more fully expressed reasons which led the medical boards at the chief sea-port towns of India to pronounce cholera to be epidemic or not epidemic. When the board reported the disease to be not epidemic, a clean bill of health was given; but if the disease was epidemic, the last report of the medical board showing the number of cases that had proved fatal, and the reasons why these deaths constituted an epidemic, was attached to a bill of health, which only certified to the sanitary condition of the vessel itself. In practice, however, this revised procedure did not lead to any greater confidence being placed upon the *bonâ fides* of clean Indian bills of health for the reason that ships sailing under the Turkish flag, when furnished with a clean bill of health from the British authorities, took also with them a bill from the Ottoman Consul, Bombay, in which the number of deaths from cholera during the previous week were noted. Although these deaths did not in the opinion of the Bombay Medical Board constitute an epidemic, yet the mention of any deaths from cholera aroused suspicion in foreign ports. In order to avoid this, changes were made in the form of the weekly board's reports, and in the form of bills of health. The members of medical boards were instructed to subdivide the column showing the number of deaths during the week from cholera into two, headed respectively "epidemic" and "sporadic," and to enter the deaths under either column as they might think necessary. At the same time the bill of health was modified and local maritime governments were asked to instruct their port officers to advise captains of vessels to obtain on the bills of health, whenever practicable, the visa of the Consul of the country to which the vessel is bound. It is, therefore, hoped that the Indian bills of health will meet all requirements, and that there need no longer be any ground for want of confidence in them.

Scientific Memoirs.

The third part of the "Scientific Memoirs" issued contemporaneously with this report show a continued vigorous development of the issue, and contains the following papers:—

1.—Notes from the Biological Laboratory attached to the Office of the Sanitary Commissioner with the Government of India.—*D. D. Cunningham.*

2.—Note regarding certain characters in the Sub-Soil of Calcutta.—*D. D. Cunningham.*

3.—On a new Genus of the Family Ustilagineæ.—*D. D. Cunningham.*

4.—On an Entophytic Alga occurring in the Leaves of Limnanthemum Indicum, with Notes on a peculiarly parasitic variety of Mycoidea.—*D. D. Cunningham.*

5.—The Fly-catching Habit of Wrightia Coccinea.—*A Tomes.*

6.—Note on the occurrence of a minute Blood-Spirillum in an Indian Rat.—*H. Vandyke Carter.*

7.—On the lately demonstrated Blood-contamination and Infective Disease of the Rat and of Equines in India.—*H. Vandyke Carter.*

8.—Observations on Bacteria in Cholera.—*G. Bomford.*

9.—On the Phenomena of Propagation of movement in Mimosa Pudica.—*D. D. Cunningham.*

10.—Note on some Aspects and Relations of the Blood-organisms in Ague.—*By H. Vandyke Carter.*

Of these papers, it is necessary here only to note briefly those which have a pathological bearing.

In his "Notes from the Biological Laboratory," Dr. D. D. Cunningham records the results of his investigations on various points in connexion with the etiology of cholera. The publication of a paper in the Proceedings of the Royal Society, affirming the existence of peculiar organisms in the tissues of cases of cholera, gave rise to a special renewed examination of specimens treated according to the methods described as demonstrative of the phenomenon. The result, however, clearly showed that the presence of bodies of the nature described in the paper is not a constant concomitant of the choleraic condition, and cannot, therefore, be regarded as of any special importance. A series of experiments was also tried in regard to the power of choleraic comma bacilli to maintain themselves in the struggle for existence to which they must, under normal circumstances, be exposed when external to the human organism and apart from the provision of special sterilised media. The experiments were of small number, but so far seemed clearly to indicate that choleraic commas are highly deficient in power of holding their own when in conflict with other schizomycete organisms normally present in the media to which they are specially liable to gain access. They also showed that in these media, at all events, the commas were incapable of continued active saprophytic existence for any length of time, and failing to assume any persistent resting condition tended to disappear rapidly and permanently.

The fact of the excessive multiplication of commas within the peritoneal cavity in guinea-pigs dying in consequence of the subcutaneous injection of fluids containing such organisms, led to a careful examination of the peritoneal secretion in cases of cholera; but not only was there no evidence of the presence of any condition parallel to that in the experimental cases, but in no instance could the presence of any choleraic commas be detected.

Special attention was devoted to the phenomenon of the occurrence of spirilloid organisms in the blood of horses and other animals in health and disease, and the conclusion was arrived at that, in so far as the data at present available go, there is no sufficient evidence to show that the organisms possess any specific pathogenic properties.

Dr. Bomford in his paper gives the results of microscopic examinations of various tissues in nine cases of fatal cholera at the General Hospital, Calcutta. The intestine was examined in seven cases, and in only one of these could curved bacteria be demonstrated in the proper substance of the mucous membrane, although in two other cases they were abundant on the surface and in the cavities of the glands. In the one exceptional case they had penetrated even below the mucous membrane. Other forms of bacteria are described as occurring in lesions of the lungs, stomach, and in one case the kidney. These were found chiefly in prolonged cases of secondary fever, and resemble the bacteria always associated with putrefactive changes. Their presence appears to throw some light upon the nature of this phase of the disease.

Lastly, Dr. H. Vandyke Carter contributes three papers. The first describes a minute spirillar organism found in the blood of the Indian rat, which is noteworthy on account of its rarity and non-pathogenic character although apparently of bacterial nature; by experiment this infection was not found communicable. The second, on the subject of the equine "surra" disease of India, and the common blood infection of rats described by Lewis, gives independent descriptions of the peculiar hœmatozoon

common to both horse and rat, which, in general, confirm earlier accounts. A third paper is on the blood-organisms found in ague. The author thinks he has been able to confirm in most respects the discoveries of Dr. Laveran, "medecin-major" in the French Army of Algiers, as well as to some degree the observations of Dr. Marchiafava, Professor in Rome. About 120 cases of malarial and other fevers were submitted to scrutiny, and in a small proportion of those more distinctly malarious, the pigmented monads were found, and are here described.

ABSTRACT OF REPORT OF THE ACTING SANITARY COMMISSIONER FOR MADRAS FOR 1886.

(*Surgeon-Major J. A. Laing.*)

European Troops.

Sickness and mortality among European troops.

The strength of Her Majesty's European troops belonging to the Madras Presidency in 1886 was 17,189.

The health of the troops was not as satisfactory as in the previous year, there having been an increase in the daily sick, admission, and death rates. The admission sick-rate for the year was 1,367·8 and the daily sick-rate 80·8 per 1,000 men, against 1,165·3 and 66·1 respectively, in 1885. The mortality, 16·0 per 1,000 men, is the highest that has been since 1879.

The subjoined statement gives, for a series of years, the chief facts connected with the health of European troops serving in Madras:—

Years.	Ratio per 1,000 of Strength.			Invalided per 1,000 of Strength.	
	Admitted.	Daily Sick.	Died in and out of Hospital.	Change of Climate.	For Discharge.
1870	1,481·5	63·9	19·7	70·4	6·6
1871	1,211·5	56·2	19·1	29·7	12·5
1872	1,352·3	59·7	19·2	26·8	11·2
1873	1,270·8	59·3	18·5	50·6	12·7
1874	1,141·2	57·6	13·4	29·5	8·3
1875	1,096·3	56·9	14·8	60·8	15·5
1876	1,132·9	55·2	16·1	31·9	10·9
1877	1,172·2	58·7	17·2	36·0	10·2
1878	1,379·7	65·8	22·1	36·6	9·1
1879	1,438·7	68·4	16·8	34·3	10·2
1880	1,385·4	68·4	9·9	15·0	8·0
1881	1,164·8	68·2	11·1	18·6	8·8
1882	1,069·4	59·3	10·4	17·6	12·0
1883	991·0	59·7	10·0	20·1	13·6
1884	1,106·1	59·1	8·5	20·9	11·4
1885	1,165·3	66·1	9·2	—	—
1886	1,367·8	80·8	16·09	—*	—*

* Information not available.

Excluding depôts and very small stations, the average daily sick-rate per 1,000 of strength ranged from 162·9 in Thayetmyo, to 56·6 in Bangalore. The death-rates varied from 54·8 at Thayetmyo, to 3·5 in Kamptee.

The most common causes of inefficiency amongst the troops were venereal diseases and fevers.

There was only 1 admission "on the march" from cholera, and 1 death, which took place at Rangoon.

There was only 1 admission from small-pox against 6 in 1885, which case occurred in Poonamallee. There were no deaths from small-pox either in 1886 or 1885.

There was a very marked increase in typhoid fever in 1886 compared with 1885. The admissions numbered 136, against 73 in 1885, and the deaths 43, against 23. Secunderabad and Bangalore suffered the most; in the former there were 76 admissions and 25 deaths; and in the latter 30 admissions and 8 deaths.

Paroxysmal fevers were much more prevalent in 1886 than in 1885. The number of cases admitted into hospital in 1886 of intermittent fever was 1,506, and of remittent fever 76, against 713 and 50 respectively in 1885.

The admissions for diarrhœa were at the rate of 58·3 per 1,000 of strength, and numbered 653, against 429 in 1885. The deaths were 4 (2 in Thayetmyo, 1 in

Toungoo, and 1 in Rangoon) or 0·2 per 1,000. There were 781 admissions, with 27 deaths, from dysentery, against 602 and 4 respectively in 1885. The ratios per 1,000 of strength of 1885 were, therefore, for admissions 69·3, and for deaths 2·4. The admissions were most numerous in Secunderabad and Poonamallee. The largest number of deaths (7) occurred in Madras and the next largest (4) in Rangoon.

The admissions from hepatic diseases were 301, and the deaths 13, against 354 and 14 in the previous year. The results for 1886, therefore, give an admission-rate of 26·9, and a death-rate of 1·2 per 1,000 men.

Sun-stroke and heat apoplexy caused 14 admissions and 5 deaths, against 15 and 4 respectively in 1885.

Venereal diseases were less prevalent in 1886 than in 1885, the admission-rate per 1,000 of strength having been 262·3 in the former, and 308·3 in the latter. Although the admission-rate was less in 1886 than in 1885, still it was higher than in any of the years from 1872 to 1884. In the year under review, the admissions were most numerous in Secunderabad, Bangalore, Bellary, and Rangoon.

Native Troops.

Sickness and mortality among Native troops.

The strength of the Native army serving in the Madras Presidency in 1886 was 31,172.

The troops were not so healthy as in the previous year, the admission-rate per 1,000 of strength in 1885 having increased from 660·0, and the daily sick from 28·9 to 809·1 and 34·3 respectively in 1886. There was also an increase in the death-rate as compared with that for 1885. In 1886 the death-rate was 15·2, whereas in 1885 it was only 9·2.

The principal causes of sickness amongst Native troops were intermittent fever and skin diseases. The most fatal complaint was cholera, which caused 57 deaths, a ratio of 2·8 per 1,000 of strength. Fifty-two deaths from cholera occurred "on the march," 4 in Secunderabad, and 1 in Cannanore. Next to cholera, the most fatal complaints were respiratory diseases, the death-rate from these being 2·4 per 1,000 men. The other diseases which mainly contributed to the mortality were remittent fever (1·4), diarrhœa (1·2), dysentery (1·0), and intermittent fever (0·3).

There were 6 cases of small-pox, but no deaths, against 24 cases and 1 death in 1885. Five cases occurred in Bangalore, and 1 in Dharwar.

The admissions for venereal complaints were 334, or a ratio of 16·3 per 1,000 of strength, against 17·2 in 1885.

Jails.

Sickness and mortality in jails.

The prison population on 31st December 1886 numbered 7,307, and during 1886 the additions to it amounted to 15,615, making a total of 22,922, or 491 less than in the previous year. During 1886 there was a decrease of 15,723. The number remaining in jail at the end of 1886 was thus reduced to 7,199, against 7,307 in 1885. The sick admission-rate per 1,000 of strength of the entire jail population in 1886 was 756·7, and the death-rate 16·9, against 701·9 and 17·4 respectively in 1885. The admission sick-rate per 1,000 was higher than that (701·9) in 1885, but the death-rate was lower than in any other year on record.

The chief causes of admission into hospital were remittent fevers, skin diseases, diarrhœa, and dysentery. Contrasting the prevalence of these ailments with the results for 1885, there was an increase in fevers, but a decrease in the others. There were cases of fever in all the jails except in Bellary District Jail, and the largest numbers occurred in the Central Jail Rajahmundry, and Chittoor Jail. In one jail (Trichinopoly Central Jail) there was an admission from cholera. Of the 12 cases of small-pox, 4 occurred in Madras Penitentiary, 2 in Calicut, 2 in Tanjore, and 1 in each of the following jails: Madura, Rajahmundry Central Jail, Salem Central Jail, and Coimbatore Central Jail.

For some years there has been a steady decrease in the death-rate of our jails, the decline having been from 55·8 in 1879 to 16·9 in 1886. In 1885 the death rate was 17·4. The rates in 1886 ranged from 44·2 in Cannanore Central Jail to 3·9 in Madura Jail. In three jails (Her Majesty's Jail, Madras, Ootacamund (European) Jail, and Rajahmundry District Jail) no deaths occurred. There were 2 deaths from small-pox, 1 in Tangore, and 1 in Coimbatore Central Jail. No deaths from cholera occurred during the year. The highest death-rates were from dysentery (2·4) and respiratory diseases (2·0).

General Population.

Vital statistics.

The work of registration of births and deaths was carried out, as in former years, by means of registrars in municipal towns and by curnams in villages, with the addition that the district medical and sanitary officers now inspect the registers when on tour. I would suggest that the tabulation of the vital statistics of all towns and villages be done by the district medical and sanitary officers, as I am of opinion that they could then exercise more efficient supervision over the compilation of the returns; not only so, but the district medical and sanitary officers would then be cognizant of the state of health of their districts, and could at once offer such advice as appeared necessary to the Presidents of District Boards, in the case of any unusual prevalence of disease, &c.

In the Madras Presidency, during the year 1886, there were 855,034 births registered, against 824,042 in 1885, showing an increase of 30,992 for the year under report. The ratio per 1,000 of population was 30·4, the highest on record in this Presidency.

In all the districts the birth-rate was higher than the average for the previous 10 years. In 13 districts the rates per 1,000 of population were higher than those for 1885, and in eight they were lower. The highest birth-rates registered during the year under report were 42·0 per 1,000 in Chingleput district and 41·8 in Kurnool district. In the preceding year also the birth-rates were high in these districts, and it may be that greater attention is paid to registration in these districts. Excluding the Nilgiris, the birth-rate was lowest in the Vizagapatam district (23·0), next to it in Ganjam (23·2), and then in Godávari (23·7). These districts also returned low birth-rates last year, and shows that registration of births in them is defective.

The birth-rates in the urban and rural populations were 29·5 and 29·9 respectively, against 28·8 and 28·7 in 1885. In 12 districts—Kistna, Chingleput, South Arcot, North Arcot, Trichinopoly, Tanjore, Tinnevelly, Kurnool, Cuddapah, Salem, South Canara and Bellary, and Anantapur, the birth-rates were higher in rural than in urban populations. This result is no doubt due in a measure to the fact that domestic occurrences obtain more local notoriety in villages than in towns of large size. In four districts—Salem, Chingleput, Coimbatore, and Malabar—there was a marked difference between the rural and the urban population.

There are in the Madras Presidency 54 municipal towns, excluding Madras. In only 17 towns has the birth-rate been above 35 per 1,000 of population, and in 23 it has been below 30. The highest birth-rate (49·5) was obtained by the Karúr municipality, and the lowest (5·2) by Vániyambádi. It is to be regretted that the bye-laws making the registration of births and deaths compulsory in municipalities are not more strictly enforced, as the low birth-rates in many municipalities show the very defective manner in which registration of births is conducted.

During 1886 there were 437,598 male and 417,436 female births registered. The preponderance of male births to every 100 females was in the ratio of 104·8 for the Presidency; but in a few districts it was greater than this.

The births exceeded the deaths in all districts except Godávari. The excess per 1,000 of population ranged from 21·3 in Anantapur and Bellary to 1·1 in the Nílgiris. The excess of deaths over births in the Godávari district was only 0·7 per 1,000, and was due, putting aside defective registration, to the prevalence of cholera. The increase of the population was 10·7 per 1,000 in 1886, against 7·5 in 1885.

The total deaths registered in 1886 were 553,927, giving a death-rate of 19·7 per 1,000 of population. In the previous year the deaths were 615,449, or 61,522 more than in 1886. The following table shows the number of deaths registered since 1869:—

Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000	Years.	Population for which returns were received	Deaths.	Death-ratio per 1,000.
1869	24,633,127	451,981	18·3	1878	29,127,205	810,921	27·8
1870	24,125,526	451,020	18·6	1879	28,991,267	549,390	18·9
1871	24,555,046	444,371	18·0	1880	28,778,097	454,101	15·7
1872	30,147,779	501,482	16·6	1881	28,676,375	465,682	16·2
1873	30,287,842	506,894	16·4	1882	28,887,111	470,700	16·2
1874	30,360,221	516,848	17·0	1883	28,503,100	541,930	19·0
1875	30,278,903	641,260	21·1	1884	28,151,952	650,335	23·1
1876	29,157,056	680,384	23·3	1885	28,118,178	615,449	21·8
1877	29,209,542	1,556,312	53·2	1886	28,043,538	553,927	19·7

It will be remarked that the death-rate was less than in the two previous years, and the decrease was mainly due to the decline of cholera and small-pox in 1886.

The death-rate for males (20·4) was higher than the death-rate for females (19·0). For every 100 females who died, 105 deaths among males were registered, but the proportions vary considerably in some of the districts.

The mortality amongst infants under one year of age is as usual very high (24·1 per cent. of the total deaths) when compared with the deaths at other periods of life. The deaths under five years of age formed 38·8 per cent. of the total deaths and this high rate of mortality is a sure indication of insanitation. The period when fewest deaths occurred was in the age of above 10 and under 15, the death-rate being 5·0 per 1,000. The percentage on total deaths amongst infants under one year of age is 24·1 against, 21·2 in 1885. From infancy up to 10 years of age females have a better chance of life than males, and also from 30 years upwards. Between the ages of 15 and 30 years, however, the death-rate amongst males is less than that of females.

According to classes, the death-rate among Hindus during the year under review was 19·9 per 1,000 of population, among Mahomedans 18·3, among Native Christians 14·6, and among other classes 14·0. In 13 districts (Godávari, Kistna, Nellore, Madras, Chingleput, Trichinopoly, Tanjore, Madura, Tinnevelly, Kurnool, Cuddapah, Coimbatore, and Nílgiris) there were no deaths amongst other classes, but in Salem the death-rate was 185·1 per 1,000 amongst "other classes."

In all districts, with the exception of four, the most unhealthy month was December. In Tinnevelly and South Canara districts the mortality was greatest in January, in Malabar in July, and in the Nílgiris in June. The most healthy month was that of April. The highest district death-rates were Madras 36·1, Chingleput 25·6, Godavari 24·4, and the lowest Coimbatore 15·4, Nellore 15·4, and Ganjam 16·3.

The average death-rate for the 54 municipal towns, excluding Madras, during the year was 23·6 against 25·4 in the preceding year. The highest death-rates were registered in the towns of Conjeeveram (33·6), Ongole (33·0), and Coimbatore (32·9). The lowest death-rates were in Vániyambádi (6·7), Tirupatúr (10·9), Coonoor (11·0), and Cuddalore (13·0).

Chief diseases.

The general health of the Presidency appears to have been good, though fever prevailed in some districts. There was a marked decrease as compared with the previous year in the number of deaths from cholera and small-pox. The following abstract shows the chief causes of disease for a series of years:—

Table showing the Deaths from different Causes during the year 1886, *compared with previous years.*

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866 - - -	600,106	200,961	23,106	110,102	—	9,047	256,890
1867 - - -	372,026	33,205	27,907	112,511	—	8,613	189,790
1868 - - -	390,956	8,036	34,330	105,692	—	9,242	233,659
1869 - - -	451,981	21,034	17,448	132,346	—	9,310	271,843
1870 - - -	451,020	55,867	11,252	151,027	—	12,325	220,549
1871 - - -	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872 - - -	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873 - - -	506,894	840	51,784	222,843	36,392	14,251	180,784
1874 - - -	516,848	313	48,343	226,220	37,993	13,065	190,914
1875 - - -	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876 - - -	680,384	148,193	23,469	230,092	38,176	11,175	229,279
1877 - - -	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878 - - -	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879 - - -	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880 - - -	454,101	613	14,529	209,940	19,622	10,845	198,552
1881 - - -	465,682	9,446	15,776	203,542	18,961	11,527	206,430
1882 - - -	470,700	23,604	20,159	188,561	19,958	11,611	206,807
1883 - - -	541,930	36,284	37,975	203,786	22,098	11,509	230,278
1884 - - -	650,335	75,476	61,247	215,977	28,775	11,502	257,358
1885 - - -	615,449	58,109	34,726	218,786	31,209	11,659	260,960
1886 - - -	553,927	12,417	17,129	221,679	27,379	13,103	262,220

Cholera.

The total number of deaths registered under the head of cholera in 1886 was 12,417, or 45,692 less than in the previous year. The epidemic, which appeared to begin in the last quarter of 1881, and attained its maximum intensity in 1884, seems now to be on the decline. Of the total 12,417 cholera deaths registered, 11,287

occurred in the districts situated on the coast north of Madras, of which 7,053 took place in Godávari district alone. In eight districts (Madura, Tinnevelley, North Arcot, Anantapur, Bellary, Kurnool, Coimbatore, and South Canara) no deaths from cholera were reported, and in eight (Chingleput (1), Nílgiris and Trichinopoly (2 each), Madras (3), Salem (5), South Arcot (13), Tanjore (30), and Cuddapah (35), the deaths ranged from 1 to 35. The districts that suffered the most were Godávari (7,053), Kistna (2,919) and Malabar (1,039).

There was no month in the year when cholera was absent from the Madras Presidency. In January there were 1,224 cholera deaths reported from nine districts. In February and March a decline took place, as there were 554 deaths in the former and 582 in the latter month. During April the mortality rose to 1,219, and reached its maximum for the year in May, when 1,597 deaths were reported from this cause. In June there was a decrease, but in July again an increase, when 1,564 deaths were reported. In August and September there was again a decrease, but in October the deaths rose to 1,111. During November and December there was a decrease, and in the latter month 935 deaths were reported, and the disease was present in only six districts.

In the districts exclusive of municipal towns the highest number of deaths (6,738) took place in the Godávari district. Next in order comes Kistna, the adjoining district, where the deaths reported were 2,822. In Malabar the mortality from cholera was 994.

The following towns suffered most—Rajahmundry with a death-rate of 5·6, Ellore 4·4, and Anakápalle 3·6. On comparing the death-rates of the municipal towns with those of the districts, it is seen that the highest death-rate (5·6) was in the town of Rajahmundry, and the next that of Ellore (4·4). In two districts (South Arcot and Salem) which reported deaths from cholera, the municipalities escaped altogether. In Malabar, where 994 deaths occurred, only one of the five municipalities in the district were affected, viz., Calicut, from which 45 deaths were reported.

The epidemic of cholera, which reached its maximum intensity in 1884, and which now shows signs of subsided activity, has again proved that all the measures adopted at the time the disease is prevailing are only palliative. Our efforts must therefore be directed at all times, irrespective of epidemic seasons, to carrying out those sanitary measures which are known to be antagonistic to the prevalence of disease, by insisting on cleanliness of the soil by strict conservancy, in preserving water-supplies from defilement, and by improving the drainage. These measures, when strictly acted up to, have been effectual in warding off cholera as well as other diseases.

Small-pox.

There was a considerable decrease in the deaths from small-pox, the numbers having fallen from 34,726 in 1885 to 17,129 in 1886. Of the total deaths, 8,666 were males and 8,463 females. There is a marked decrease of 17,597 cases for the year under review when compared with that for 1885, and in only two years (1880 and 1881) were the death-rates (0·5 in each) below that for 1886 (0·6).

Of the total deaths, 10,238, or nearly 60 per cent., were in children under 12 years of age, 19·0 per cent. occurred among infants under 1 year of age, whilst 40 per cent. were in children above 1 and under 12, and the remaining 40 per cent. among persons over that age. The liability of the young to small-pox is thus illustrated, and the necessity for vaccinating at an early age seen.

The greatest small-pox mortality occurred in North Arcot and Malabar (1·1 each), and Tinnevelly (1·0). The districts in which the disease was most prevalent are those in which vaccination is carried on under many disadvantages, owing to the passive opposition and caste prejudices against the operation. The districts which suffered least were Madras (0·002), Tanjore, Chingleput and Kistna (0·1).

Of the 54 towns, in 46 there were deaths from small-pox registered, and in 8 no deaths were returned. The highest mortality (6·4) was in Cochin in the Malabar district, and excluding Madras, the lowest (0·03) in Cannanore. In Madras town in 1886 there was only one death registered from small-pox. On comparing the small-pox mortality of districts with that of municipal towns, it is found that the highest rates were in municipalities. The highest rate among districts was 1·1, but there were 12 municipalities with higher rates than this, viz., Cochin (6·4), Coimbatore (5·5), Calicut (3·5), Gudiyátam (2·4), Periyakulam (2·2), Wálajápet (2·1), Vániyambádi (2·1), Tirupatúr (1·8), Tellicherry (1·7), Tuticorin (1·6), Tirupati (1·4), and Negapatam (1·2).

On the whole, I am of opinion that vaccination is becoming more appreciated by the people, although in some districts there is still a great deal of opposition, and vaccinators find great difficulties in extending the benefits of the prophylactic.

Fevers.

During 1886, there were 221,679 persons reported as having died from fevers—113,692 were males and 107,987 females. Compared with 1885 there was an increase of 2,893 deaths for the year under review. Fevers caused 40·0 per cent. of the total deaths. The maximum mortality took place in December in all districts with the exception of six. In Malabar and South Canara districts the largest number of deaths occurred in the month of July, in Trichinopoly in November, in Madras in January, in Madura in March, and in the Nílgiris in June. The minimum number of deaths was reported in the month of April, when 14,832 were registered.

In the districts exclusive of municipal towns the highest death-rate in 1886 (17·0) occurred in the Kurnool district, and the lowest (1·3) in Tanjore district. In 1885 the largest mortality was also in the Kurnool district, and the lowest in Tanjore. In 15 districts the ratios of deaths were in excess of the mean rate for the previous five years, and in six less.

In Tirupati municipality the death-rate was highest (14·5), and in Masulipatam lowest (1·1).

On comparing the death-rates from fevers in the districts and towns, it is found that in only 12 municipal towns was the mortality greater than that of the districts, and this shows the necessity for improving village sanitation. All the municipalities in Tanjore district show higher death-rates than that for the district.

Bowel-complaints.

The number of deaths registered in 1886 from bowel complaints was 27,379 against 31,209 in 1885, showing a decrease of 3,830 cases for the year under report. The death-rate for 1886 was 0·9 per 1,000 against 1·1 in 1885, and 1·0 in 1884. In 13 districts the death-rate was higher than the mean for previous five years, in seven lower, and in one equal. The most fatal month was that of July, and the fewest deaths occurred in April.

Madras (town) heads the list of districts with a ratio of 6·5 per 1,000, and next comes Chingleput with a ratio of 4·2. The lowest death rate from bowel complaints was in Tanjore, with a ratio of 0·1 per 1,000 of population. In the city of Madras the death-rate is still high, although less than that (7·0) in 1885.

Of the municipal towns, the highest death-rate (8·4) was in Tuticorin, next Calicut, with a ratio of 6·6, and then Ellore (6·0). In two municipalities (Masulipatam and Ongle) no deaths were registered from bowel complaints.

On comparing the death-rates in towns and districts, it is seen that in 46 municipalities they were higher than in the districts. Five towns, viz., Tellicherry, Pálghat, Nellore, Adóni, and Wálajápet, had lower rates than the districts.

Injuries.

The deaths from injuries amounted to 13,103 against 11,659 in 1885, showing an increase of 1,444 cases for the year under review, and they were greater in number than in any preceding year since 1878. There was an increase under all heads, the greatest being under accidents. From suicides the total deaths registered were 1,628—700 males and 928 females. The deaths from accidents were 8,079 in 1886 against 6,815 in 1885, showing a large increase of 1,264 cases for the year under report. In Tinnevelly town alone 109 deaths occurred from accidents and wounds. The deaths from snake-bites and attacks by wild beasts were 2,418, being 48 greater than in 1885.

From all other causes the recorded deaths were 262,220 or 9·3 per 1,000 against 260,960 or 9·2 in 1885.

Vaccination.

The total number of operations performed throughout the Presidency during the year was 710,203 against 766,479 in the previous year, showing a decrease of 56,276 cases for the year under review. With the exception of cantonments, Native States, and European Army, the decrease is under all heads. The greatest decrease occurred in the outturn of work performed by local fund and municipal vaccinators. Medical subordinates attached to dispensaries have also performed much fewer cases in 1886 than in 1885, and is due to the rule which made them responsible for vaccination in the towns in which the dispensaries are situated having been cancelled.

The decrease is due to the decline of small-pox in 1886, to the prevalence of cholera in a few districts, to the absence of many vaccinators, and in one or two districts to the incompleteness of the staff. Another cause of the reduction is that vaccinators now pay much more attention to the quality of the work turned out, and do not vaccinate unless the lymph is good. In some municipalities also, which returned large number of cases

in 1885, the work was not reliable. The progress of vaccination depends a great deal on the amount of sympathy and active interest which the district officials take in vaccination and other sanitary matters of utility. When officials and municipal councillors neglect to have their own children vaccinated, it is vain to expect that the people will submit to the prophylactic.

The quality of the work was better than that of any of the previous years since 1877–78. The ratio of success in primary cases was 94·4 and in re-vaccination 64·3, which give a mean rate of 93·9. In primary vaccination the greatest amount of success, viz., 96·3, was attained by Government vaccinators, and in re-vaccination (76·9) by cantonment vaccinators. Both in primary and re-vaccinations the lowest amounts of success, viz., 54·7 and 45·6 respectively, were obtained by medical subordinates.

Of the total number successfully vaccinated 130,986 were under one year of age. 370,871 over one and under six, and 156,898 above six years. The largest number of operations was, as usual, performed on children over one and under six years of age. Contrasting these age results with those for 1885, they show a decrease under all heads. Of the total number vaccinated, 54·6 per cent. were males, and 45·4 per cent. females.

Excluding Madras town there were 322,646 cases verified (or 53·7 per cent.) of total number (599,933) vaccinated. The largest number of cases (23,059 or 95·4 per cent.) inspected was in the Vizianagrum range, as was also the case in 1885, and the smallest (1,344 or 29·9 per cent.) in the Guntúr range. On the whole the conduct of the deputy inspectors was satisfactory.

The quality of the lymph in use was on the whole good. Besides Madras town, animal vaccination was carried on in nine circles in 1886, and it is very desirable that it should be introduced in all circles where difficulties are experienced in getting vaccinifers.

During the year Government sanctioned vaccination being made compulsory in the towns noted in the margin. In Madras town, where vaccination is compulsory, only one death from small-pox was reported in 1886. It is also very desirable that re-vaccination be carried on in schools. This might, I think, be introduced without difficulty, for, as a rule, grown-up boys are usually willing to reason in this matter.

Rajahmundry.	Tinnevelly.
Anantapur.	Cuddapah.
Palamcottah.	Nellore.
Ellore.	Máyavaram.
Negapatam.	Adóni.

Sanitary Works.

Municipalities.

As in the preceding year, no new works of any importance were undertaken during 1886; various minor improvements, however, were carried out, which consisted in the sinking and repairing of wells and tanks; in the construction and repair of permanent and temporary latrines, drains, dust-bins, markets, slaughter-houses, &c., and in improvements of town sites and of water supply. In Madura Rs. 23,494 were spent in the construction of hydrants in connexion with the water supply of the town, and in Pâlghat and Ootacamund a new patent latrine in each was put up, in the former of the Crawford pattern, and in the latter of the Horbury's pattern. The sources of water supply and the systems of conservancy were the same as those detailed in former reports. In most of the towns certain tanks and wells are selected and reserved for drinking purposes only, and guarded from pollution. A great desideratum in most of the municipalities is a complete and efficient system of drainage both of streets and houses. At present the drainage of streets in too many instances is only partial, and the drains are faulty in construction, and badly laid, with no satisfactory outlet. House drainage is very unsatisfactory, and in many cases it is practically nil. In regard to conservancy, greater attention is being gradually paid to surface cleansing, as is evidenced by the increased staff employed generally year after year. Uncleaned cesspools and filthy backyards and premises are great sources of danger to public health, and these, unfortunately, are too often found to exist. Private scavengering and domestic cleansing are the remedies to be adopted to effect a reform in these respects. It is satisfactory to note that some progress has been made in this direction during the year under review, as 1,123 more private latrines than in 1885 were brought under municipal management, thus raising the total number attended to by municipal scavengers, 19,204, to 20,327.

The total estimated income of all the municipalities in the mofussil, *i.e.*, excluding Madras, amounted to Rs. 18,56,720 during 1886–87, against Rs. 18,79,490 in the previous year; thus showing a decline in the revenue on the whole, notwithstanding the extension of the Municipal Act to seven new towns, which brought in an income of

Rs. 71,570. If these seven towns be not taken into account, the total income of those that were in existence last year would then fall far more short of that for 1885–86; it would be reduced by Rs. 94,340, and represent an incidence of Rs. 1–5–4 per head of population against an incidence of Rs. 1–6–5 in the previous year. The incidence, including the income of the seven new municipalities, amounts to Rs. 1–4–7. It is satisfactory, however, to note that, with limited resources and shorter income, more money was set apart for sanitation on the whole than in the preceding year. The sanitary allotment for the year under notice, including the provision made by the seven new municipalities, amounted to Rs. 6,48,473 against Rs. 5,98,220 in 1885–86, being an increase of Rs. 50,253, or more than half a lakh. But if the seven new municipalities be eliminated, the actual increase over the preceding year's allotment would amount to only Rs. 27,498, or more than a quarter of a lakh. In some towns the allotments were increased over those of the preceding year, while in others they were reduced. The sum total of increases amounted to Rs. 1,21,169, and the decreases to Rs. 70,916, thus showing a net increase, as stated above, of Rs. 50,253. The largest increase was made by Madura (Rs. 40,100), chiefly in the items of water-supply and conservancy, and the lowest by Rajahmundry (Rs. 10). The greatest reduction took place in Ootacamund (Rs. 40,650), which was confined chiefly to the items of construction and repair of markets and slaughter-houses and conservancy. In 1885–86 a special grant was made by this municipality for the erection of new market buildings, the necessity for which did not arise in 1886–87. Of the total allotment, Rs. 4,00,194 or 61·7 per cent. was set apart for conservancy; Rs. 39,944 or 6·1 per cent. for improvement of town sites; Rs. 95,554 or 14·7 per cent. for improvement of water-supply; Rs. 4,475 or 0·6 per cent. for sanitary arrangements during fairs and festivals; Rs. 27,203 or 4·1 per cent. for construction and repair of markets and slaughter-houses, and Rs. 81,103 or 12·4 per cent. for other sanitary objects.

From the above it will be seen that conservancy took the largest share of allotments (61·7 per cent., or a little under three-fourths of it).

Proportionally considered to estimated income, the allotment was in the ratio of 34·9 per cent, against 31·4 per cent. in 1885–86. The percentages varied in the several towns from 10·3 in Pálghat to 60·8 in Pariyakulam. Excepting in some few towns, the allotments made were satisfactory generally. In twelve towns the allotments ranged from 40·8 in Bellary to 60·8 in Periyakulam, a new municipality. Next to Periyakulam stands Madura, with the highest percentage of allotment (56·1), followed by Kumbakonam (52·9), Vellore (51·3), and Trichinopoly (50·6). In 15 towns the allotments were between 39·1 and 30·5 per cent.; in 21 towns they were between 29·6 and 20·8 per cent., descending to 10·3 per cent. each in Ongole and Pálghat.

Of the total sanitary allotment, only Rs. 3,76,925 or 58·1 per cent., being a little more than half, were spent in nine months of the year ending with December 1886, leaving Rs. 2,71,548 or 41·9 per cent., nearly one half, to be expended in the remaining three months of the year. But taking the figures for 1885–86 which represent the expenditure for the whole year, we find that out of an allotment of Rs. 5,98,220, Rs. 5,58,278 were expended, thus leaving Rs. 39,942, or 6·6 per cent. unutilized.

District Local Fund Boards.

There was no change in the constitution or number of the District Local Fund Boards during the year. There were 21 in number as in the preceding year. No new works of any importance were undertaken during the year. As usual, the sanitary works executed consisted chiefly in the sinking and repairing of wells, in the construction and repair of tanks, latrines (permanent and temporary), drains, dust-bins, cinerators, &c., and in improvements of village sites and water-supply generally. The sources of water-supply for drinking purposes were the same as those in last year, nor was there any change in the systems of drainage and conservancy. Conservation of water-supply continues to receive increased attention by the appointment of peons and watchmen to guard the sources against pollution. Drainage consists chiefly of side-cuttings to carry off storm water. In some few towns masonry drains exist. Drainage from houses either flows into the side-cuttings or into drains wherever they exist, or into cess-pools or into the backyards, where it soaks in the soil. Conservancy establishments were maintained in the cusbah towns and large villages, where supervision can be more easily exercised, according to the circumstances of each. 563 small towns and large villages, against 557 in 1885, were thus conserved out of a total of 51,930. The street sweepings and other rubbish, &c., and nightsoil were carted away to a distance and were either buried or burnt or used as manure in the fields. Tinnevelly stood pre-eminent in having conferred the benefits of conservancy establishments on the largest

number of towns and villages, viz., 84, out of a total of 1,494 in the district. Next to it comes Godávari, with 58 conserved villages, and Cuddapah with 48. In Godávari the number was reduced from 60 in 1885 to 58, thus showing a retrograde movement, though the district stood high on the list comparatively. There appears a decrease in some other districts also, but notably so in Salem, where the number of conserved villages and towns was reduced from 40 in 1885 to 22 in 1886. Coimbatore has shown a laudable example by the entertainment of conservancy establishments in 21 more towns and villages than in 1885, thus raising the number from 10 to 31 in 1886. There was a slight increase of 3, 2, and 1 in the number of conserved villages in six other districts, and in nine districts the numbers were the same as in the preceding year.

Greater interest is now being manifested in the districts generally in sanitation, and it is hoped that the establishment of taluk boards and unions and the greater powers now given under the District Boards Act I of 1884 to local authorities will be conducive in the future to progress in sanitary reform.

The aggregate total amount set apart for sanitary purposes by all the districts for the year was Rs. 3,64,601 or 28·6 per cent. of available income, against Rs. 3,41,504 or 24·7 per cent. in 1885. Taken as a whole, the allotment is fair. The percentages varied in the several districts from 2·7 in Malabar to 81·3 in Coimbatore; next to Coimbatore, Kurnool made the largest grant proportionally to available income, viz., 45·5 per cent.; next to it Salem, 40·5, and next to it again Nilgiris, 39·7. In 12 districts the allotment ranged ranged from 37·3 to 20·1 per cent. In Malabar 2·7 per cent., Nellore 7·1, South Canara 8·3, Ganjam 13·3, and Madura 17·3, the percentages were low.

Of the total sanitary grant of Rs. 3,64,601, only Rs. 1,80,434, or a little less than one-half, were spent in nine months ending with December 1886, leaving Rs. 1,84,167 to be spent in the remaining three months of the year 1886-87. Although the allotment made by the Coimbatore District Board is very high, 81·3 per cent. of income, yet only Rs. 11,057 of it, or a little more than one-fifth, were spent during the nine months. Taking the figures for 1885-86, which represent the expenditure for the whole year, out of the total sanitary allotment of Rs. 3,98,041, only Rs. 2,89,922 were spent, leaving Rs. 1,08,119 unexpended. In no district, except Vizagapatam, was the full amount utilized. In Coimbatore, where the sanitary grant was the highest as in 1886-87, viz., Rs. 62,560, only Rs. 27,559 were spent for the whole year, or less than one-half.

General Remarks.

Dr. Bidie, C.I.E., held charge of the Sanitary Commissionership from 4th April 1885, to 14th April 1886, when he was promoted to act as Surgeon-General. He was succeeded by Deputy Surgeon-General W. Farquhar, M.D., who acted as Sanitary Commissioner from 14th April to 28th October 1886, when, according to notification of the Government of India, Home Department (Medical), dated 4th June, 1886, No. 228, embodied in G.O., No. 1,366, dated 1st July 1886, Public Department, he had to relinquish the appointment. I was appointed to succeed him, and took over charge of the office on the 28th October 1886.

During the year I visited the following places, viz., Gooty, Anantapur, Bellary, Adóni, Erode, Salem, Chidambaram, Negapatam, Chicacole, Berhampore, Parlákimedi, Russellkonda, Vizagapatam, Sálúr, Vizianagrum, Anakápalle, Bimlipatam, Rajahmundry and Cocanada, and besides many villages. Chittoor, Ootacamund, Coonoor, and Coimbatore were inspected during the year by my predecessors.

At each municipal town visited I invited the Municipal Commissioners to accompany me round the town, and, when they did so, pointed out the sanitary defects which I saw, and endeavoured to explain how an improvement in the general health of the people was to be looked for, by remedying these insanitary conditions, partly by the agency of municipal officers, but to a great extent by the exercise of a little care and thought and attention to common rules by the people themselves. The importance of cleanliness in and about dwellings, and the scavengering of the towns on a systematic plan were measures I urged the necessity of, and explained that by the neglect of these measures great dangers to the public health ensued. I impressed upon the people the advantages which would result if the municipal commissions were to undertake the removing of all street sweepings and town refuse to suitably selected sites outside of the town, then sold or used in a municipal farm. If, however, no need for them was found within a reasonable period, they should be burnt in cinerators.

After many years' practical knowledge with the numerous municipalities of this Presidency, I am of opinion that progress in sanitary matters is being made, and that

municipal authorities are beginning to learn the importance to local interest of protecting public health. This is more marked in some towns than in others, and depends a great deal on the interest taken in sanitation by the municipal councillors. Still an advance is being made, and there are many municipal councillors who are thoroughly alive to the necessity of sanitary reform. In Bimlipatam municipality an excellent plan is adopted, viz., the councillors meet the chairman once a week, and they all walk round the town and inspect it. This plan I would recommend to every municipality, and would also suggest that each councillor take charge of the ward and inspect it at least once a week, so as to make sure that the conservancy establishment does its work thoroughly, and the people would thus also have an opportunity of making known their wants to the councillor.

What, however, is most wanted at present is the aid of skilled engineering advice, and so I would again venture to propose the desirability of appointing a sanitary engineer for the Madras Presidency. Sanitary engineering has now become a distinct specialty, and it is very essential that the designing and superintendence of all permanent engineering works should be entrusted to an expert. In nearly all large towns there is urgent need for complete schemes of drainage, and it is important that these works be done on regular plans and not in a haphazard, piecemeal style. With a regular and complete drainage system once planned and accepted, the various parts can be carried out to completion in portions from time to time as funds are available. There is no doubt that much public good would follow if the municipalities had the aid of skilled engineering advice, besides much bad work and consequent useless expenditure would be prevented. If a chair of sanitary engineering could be established in any of the colleges, it would be a very desirable thing.

The subject of village sanitation and conservancy has been brought before Government both by Deputy Surgeon-General Farquhar and myself. This subject is really at the bottom of effective sanitation in the Presidency, and I have recommended that a beginning be made with a single town or village in a taluk, so that it may be an example to all towns and villages in the taluk. The benefits derived from efficient sanitation will thus practically be shown to the people, and in time the people themselves will understand the harm which is caused to themselves and families by neglecting simple rules of sanitation. It might also be desirable to give rewards to those village officers who keep their towns and villages clean, and who are reported by inspecting officers as taking interest in sanitation.

Another remedy in trying to enlist people in sanitary matters would be the distribution of some simple rules on sanitation (translated into the vernaculars) to all village schoolmasters, curnams, &c. The Deputy Inspector of Vaccination could distribute these pamphlets generally when on tour, and explain to the people the dangers which result from their insanitary habits.

The desirability of visiting and reporting on the sanitation of all schools and colleges by district medical and sanitary officers within their respective districts was brought before Government by Dr. Bidie. The following paragraph I quote :—

"With reference to inspection, I have to suggest that district medical and sanitary officers be authorised, when on tour, to visit and report on the sanitation of all schools and colleges (Government, local board, municipal, and those drawing grants-in-aid), within their respective districts, and required to furnish such reports in duplicate, viz., one copy to the local body to which the institution belongs, and one to the Sanitary Commissioner for submission to Government. It would greatly simplify matters if, as in the case of military hospitals, printed forms, showing the nature of the information required, were prepared and supplied to the inspecting officers."

Government sanctioned the prososals made by the Sanitary Commissioner, and reports are now received from district medical and sanitary officers, and any sanitary defects which are mentioned are at once brought to the notice of the Director of Public Instruction. I would further urge the necessity of having hygiene taught in all girls' schools, and the rules in force with regard to vaccination in boys' schools should also apply to girls' schools. Female influence is so great in ruling the mode of life in India that it is very necessary the women should be taught how dangerous insanitary habits are, and that vaccination is the chief measure in the prevention of small-pox.

The inspection reports now sent in by district medical and sanitary officers give evidence that sanitary improvements are engaging the attention of district authorities. During the year 375 towns and villages were inspected by them in the several districts of the Presidency. These periodical inspections cannot fail to do good, and effect in time a marked improvement in the sanitary conditions of towns and villages. I must notice, however, that some district medical and sanitary officers remark that they are

unable to say how far their suggestions for improving the sanitary condition of towns and villages inspected have been acted on, as they are not so advised by the local authorities. It is very important that the district medical and sanitary officers should be informed of the steps or action taken upon their suggestions, and I would therefore recommend that the reports from district medical and sanitary officers be forwarded to Government through this office, the reports then printed and forwarded by Government to presidents of district boards, as is the case with reports on fairs and festivals.

For years past the conservancy of the town of Kumbakónam was a source of great anxiety to the municipal authorities. After a good deal of discussion in the matter, the councillors in 1886 asked Government that a special officer may be lent to them to propose a scheme for the drainage of the town. In accordance with their request, Government in G.O., No. 306 M, dated 31st March 1887, deputed a competent officer to undertake the work.

The unhealthiness of the town of Chittoor, owing to great prevalence of fever, was in January 1886 brought to the notice of Government by the Collector of North Arcot, and the Sanitary Commissioner was directed to report, after due inquiry into the alleged malarious condition of the town and the causes to which it was due. Surgeon-General G. Bidie, then Sanitary Commissioner, visited the town in February 1886, and reported to the Government that, in his opinion, the unhealthiness of the town of Chittoor was chiefly due to rice cultivation, which is largely practised in the immediate vicinity of the town, with the use of night-soil and green leaves as manure. He suggested certain remedial measures, which, if carried out, would no doubt materially improve the sanitary condition of the town.

In June 1886 Deputy Surgeon-General W. Farquhar, who succeeded Surgeon-General G. Bidie as Sanitary Commissioner, solicited the attention of Government to a subject of great and growing importance, viz., the food-supplies of the people. He pointed out the great necessity that existed for a systematic inspection of all articles used as food, and of their places of production and exposure, and submitted certain proposals with this object in view. Government, approving of them, directed that a brief "Manual for the guidance of food inspectors" be compiled in simple language, adapted to the customs and circumstances of the country, and distributed to all collectors and local bodies. This was accordingly done.

The question of the water-supply of Dindigul again came before Government during the year, and certain experiments were proposed by the Public Works Department for improving the water before abandoning the well, alluded to in the last annual report, as a source of potable water. The subject has been kept in abeyance pending the results of the proposed experiments.

In May 1886 the district medical and sanitary officer, Kurnool, brought to the notice of the District Board that the Local Boards' Act V of 1884 gave no power to the authorities to prevent the spread of contagious diseases by enforcing disinfection or to protect a stream, not private property, used for drinking purposes, by preventing defilement. The question was referred by the Sanitary Commissioner for the consideration of Government, as being important, with the hope that steps may be taken to remedy the defect. The papers submitted in connexion with the subject were transferred by Government to the Legislative Department for consideration when the amendment of the Local Boards' Act is undertaken.

The recommendations of the Sanitary Commissioner that a quarterly rough analysis of the water-supply of prisons should be made by the medical officer in charge, alluded to in last annual report, received the sanction of Government, and it is now being regularly conducted.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1886.

(Deputy Surgeon-General T. G. Hewlett.)

Vital statistics.

In the Presidency of Bombay, including Sind, during the year 1886 the births of 303,376 males and 278,177 females, or a total of 581,553 children, were recorded, against 298,406 boys and 274,025 girls, or a total of 572,431 children, in 1885. They are thus 9,122 in excess of the number recorded in the previous year, whilst they exceed the mean of the preceding 10 years ending 1885 by 169,643.

The following table shows the number of births registered in each year from 1876 to 1886, their ratios per 1,000 of population, and the proportion of males to females:—

Years.	Population.	Number of Births Registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1876	16,228,774	181,872	163,612	345,484	11·21	10·08	21·29	52·64	47·36	89·96
1877	16,181,741	164,262	147,399	311,661	10·15	9·11	19·26	52·75	47·25	89·73
1878	16,181,741	128,848	114,405	243,253	7·96	7·07	15·03	52·97	47·03	88·89
1879	16,228,774	151,460	136,410	287,870	9·33	8·41	17·74	52·61	47·39	90·06
1880	16,228,774	195,285	175,588	370,873	12·03	10·82	22·85	52·66	47·34	89·91
1881	16,454,414	239,912	219,745	459,657	14·58	13·35	27·93	52·19	47·81	91·59
1882	16,454,414	255,927	235,419	491,346	15·55	14·31	29·86	52·09	47·91	91·98
1883	16,454,414	261,966	239,835	501,801	15·92	14·58	30·50	52·20	47·80	91·55
1884	16,454,414	278,986	255,737	534,723	16·96	15·54	32·50	52·17	47·83	91·67
1885	16,454,414	298,406	274,025	572,431	18·14	16·65	34·79	52·13	47·87	91·83
Mean for 10 years	16,332,187	215,692	196,218	411,910	13·21	12·01	25·22	52·36	47·64	90·97
1886	16,454,414	303,376	278,177	581,553	18·44	16·90	35·34	52·17	47·83	91·69

It is satisfactory to notice the progressive improvement which, except in the three years of famine, has taken place throughout the Presidency in the registration of births. The increase in the last two years is to be largely ascribed to the progress that has been affected by the new system of compiling the vital statistics in the offices of the Deputy Sanitary Commissioners, where the registers of births as well as those of deaths undergo very complete and searching scrutiny.

The number of births recorded in the districts of Eastern Gujarát and Sind in 1886 was higher than in the previous year, but in the remaining districts it was lower. The increase in Sind is most remarkable, as the recorded births were 21,622 in excess of those in the previous year, whilst they exceed the mean of the preceding 10 years ending 1885 by 38,615. They are, however, notwithstanding this large increase, still very far from being even approximately correct; but we have, I think, fair grounds for hoping, now that a beginning has been made, that the registration will year by year improve. The total increase for the Presidency was 10·12 per 1,000 of population above the mean of the preceding 10 years. The extremely defective state of the registration of births in the City of Bombay has been repeatedly commented upon, and I regret to be obliged again to bring it prominently to notice. Out of 56 towns in the Presidency, the City of Bombay occupies the eighth place from the bottom of the list. It is, I submit, not creditable to the leading municipality in the Presidency that so much indifference continues, year after year, to be shown to the subject. Government was pleased, last year, to direct the attention of the Municipal Commissioner to this matter; but no improvement has taken place, and, unless it is taken up in a really earnest manner, there appears to be no hope that the registration of births in this city will improve.

The recorded birth-rates among the urban and rural populations of the Presidency were respectively, 26·56 and 36·64, against 26·17 and 39·90 in 1885. Amongst the rural population of each collectorate, except Ratnágiri, Kánara, Ahmedabad, Karáchi, and Hyderabad, the birth-rates were higher than in the urban circles.

Out of the 56 towns in the Presidency, 10 returned a birth-rate exceeding 40 per 1,000. Improvement over last year is noticed in the towns of Panvel and Sukkur, in which, although the rates cannot be accepted as even approximately correct, birth-rates of 25·99 and 27·53 per 1,000 respectively were recorded against 13·91 and 15·53 in 1885. The most remarkable increase took place in the town of Lárkhána, where a birth-rate of 40·42 per 1,000 was recorded, against 29·04 in 1885. In many towns, however, the registration of births is still much neglected, and particularly, as noticed last year, in zilla stations, where one would have supposed the wishes of Government would have been more strictly attended to. For example, in the town of Thána, a birth-rate of only 6·09 per 1,000 was recorded, against 11·41 in 1885, in the town of Alibág a birth-rate of 21·33 was registered, against 28·39, and in the City of Poona 27·44 against 29·36 in 1885. In the towns of Sátára and Belgaum the recorded birth-rates were, respectively, 24·32 and 19·86 per 1,000 against 31·48 and 23·06 in 1885. Birth-rates—such as Thána, 6·09 per 1,000; Kalyán, 13·40; Amalner, 15·93; Godhra, 17·16, and those returned by Mahád, Balsár, Kaládgi, Bombay, Jacobabad, Shikárpur—are not worth the paper they are written upon. These and other municipalities, which have returned similarly inaccurate birth-rates, cannot be performing their duty properly, and I hope Government may be pleased to record its displeasure at such neglect, and to impress upon the Municipal Commissioners the absolute necessity of much greater attention being paid to this most important subject.

Among the civil population, the deaths of 200,140 males and 181,045 females, or a total of 381,185 persons, were recorded. In the previous year, 473,591 deaths, or 92,406 more than in 1886, were registered. The following statement shows the number of deaths recorded in each year since 1876 :—

1876	-	368,260	1880	-	328,673	1884	-	408,409
1877	-	627,708	1881	-	381,450	1885	-	473,591
1878	-	532,951	1882	-	343,418	1886	-	381,185
1879	-	387,542	1883	-	420,198			

so that, as compared with the three previous years, 1886 was a tolerably healthy year.

The computed death-rate per 1,000 of population in 1886 was 23·17 against 28·78 in 1885, and a decennial mean of 26·16. Omitting Sind, where the mortuary registration is still extremely defective, the recorded death-rate in the other parts of the Presidency amounted to 24·12 per 1,000 of population.

The millesimal ratio of males dying to males living was 23·55, and of females dying to females living 22·75. In 1885 these ratios were, respectively, 29·28 and 28·25. For every 100 females who died 110·55 deaths among males were registered, but these proportions vary considerably in some of the collectorates.

In 1886 the recorded death-rate per 1,000 of population was lower than in 1885 in each of the collectorates, except Ratnágiri, Panch Máhals, Hyderabad and Thar and Párkar. In the collectorates of Ratnágiri and Thar and Párkar the recorded death-rates (15·85 and 16·07 per 1,000 respectively) are manifestly very incorrect, but they are slightly in excess of those for 1885 (14·70 and 14·51). In the Panch Maháls and Hyderabad the recorded death-rates, 21·45 and 19·34 in 1886 were nearly the same as in 1885, 21·44 and 19·84 respectively. It was also lower than the annual mean of the preceding 10 years in 18 of the 24 collectorates. The exceptions being Khándesh, Karáchi, Hyderabad, Thar and Parkár, Shikárpur, Upper Sind Frontier.

In the City of Bombay the recorded birth-rate was much below the registered death-rate (18·98 and 25·62 per 1,000 respectively). The difference can only be ascribed to defective registration. In the Collectorate of Kanára the recorded birth-rate (30·79 per 1,000) in 1886 was slightly higher than the recorded death-rate (28·73). In all other collectorates the recorded birth-rates are considerably higher than the registered death-rates.

The mortality amongst infants under 1 year and children above 1 year but under 5, is, as usual, terribly high, in comparison with other periods of life. In fact, the deaths in children under 5 years of age formed 44·67 per cent. of the total deaths. As repeatedly pointed out, the extremely high rate of mortality among children of tender years affords unmistakeable proof of local causes of insanitation throughout the Presidency. The period of greatest immunity was in the age of above 10 and under 15, the rate being 5·07 per 1,000. For those "above 60 and upwards" the

mortality was at the rate of 64·63 per 1,000. The percentage on total deaths amongst infants under 1 year is 24·20 against 21·24 in 1885. For those above 1 and under 5 the percentage on total deaths is 20·47 against 21·04 in 1885. For old people above 60 and upwards the percentage on total deaths is 12·59 against 12·03 in 1885.

The subjoined table shows the deaths in 1886, arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1885 and the mean of the preceding 10 years. The causes of deaths will be briefly noticed in the next section.

Causes of Deaths.	Mean for 10 Years, 1876–85.		1885.		1886.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera - - -	25,738	1·58	37,287	2·27	167	0·01
Small-pox - - -	7,841	0·48	2,646	0·16	876	0·05
Fevers - - -	282,220	17·28	314,237	19·10	281,450	17·10
Bowel complaints - -	36,093	2·21	45,056	2·73	36,612	2·23
Injuries - - -	6,320	0·39	5,577	0·34	5,692	0·35
Other causes - - -	69,008	4·22	68,788	4·18	56,388	3·43
All causes - -	427,220	26·16	473,591	28·78	381,185	23·17

We have at present in India not sufficient data at our command to form any very accurate opinion as to what the normal death-rate really is. Our system of registration, as ordered by the Government of India, does not allow us to take into account the natural increment of the population since the date of the preceding census. If it is allowable to express an opinion on this subject, I should say that, in those years when epidemic disease is not in movement, the normal death-rate in towns would range from 30 to 35 per 1,000, and in villages from 25 to 30. If this estimate is even approximately correct, it will be seen how very imperfect the registration of deaths is in many of the collectorates; and in others, where they have been more correctly reported, what an unnecessary loss of life there is in, comparatively speaking, healthy years. The majority of the deaths recorded in our statistics are due to preventable causes, and these high death-rates must continue until efficient measures are taken throughout the land to introduce a practical system of sanitation.

An extremely high death-rate has been reported in several of the towns of the Presidency. Viramgám heads the list with a death-rate of 45·13 per 1,000. In this town, during the year, there were no deaths reported either from cholera or small-pox, so that this excessive death-rate cannot be ascribed to epidemic causes. The death-rate from fevers alone amounted to 30·70 per 1,000, whilst from bowel complaints it reached the very high rate of 12·80 per 1,000.

For the whole Presidency the death-rate for children under 1 year of age amounts to the high rate of 201·58 per 1,000, in Viramgám it reached the excessive rate of 462·30 per 1,000, so that nearly half the children who were born died before they were a year old. The rate throughout the Presidency, for children between 1 and 5, is 45·52, but in Viramgám it was 130·23 per 1,000. I have lately reported on this town, and brought to the notice of Government the many local insanitary conditions which have caused these heavy death rates. This town is surrounded on nearly three sides by water; its drinking water-supply is impure, and liable to be polluted by nightsoil. Conservancy is inadequately performed, and the arrangements for the removal of nightsoil are very bad, whilst it has insufficient latrine accommodation for the wants of the people. In short, it may be said truly that the people are simply killed wholesale by living over a damp and impure subsoil, and by breathing an atmosphere and by drinking water which are polluted with their own excrement.

Cholera.

During 1886, 89 males and 78 females, or a total of 167 persons, died from cholera, while in the preceding year there were 37,287 deaths from this cause. Of the 167 deaths 83 occurred in seven collectorates during the month of January, when the intensity of the epidemic of the preceding year suddenly ceased, as in February, throughout the Presidency, there were only 2 deaths which occurred in the city of Bombay. In March a fatal case took place in the Broach Collectorate, and in April 1 death was recorded in Bombay. In May 5 deaths were registered, 2 in Bombay,

1 in Belgaum, 1 in Broach, and 1 in Kaira. In June there were only 2 deaths in Bombay. A slight outbreak took place in Khándesh in July, and 8 deaths were recorded. In August there were 10 deaths in Khándesh and 1 in Ahmedabad. In September the disease ceased in Khándesh after causing 3 deaths; there were also 3 deaths in Bombay, and 22 in Kolaba. In October 1 death was reported in Thána and 15 in Kolába. In November there was 1 death in Bombay, 1 in Surat, and 1 in Ahmedabad, whilst in December there were 3 deaths in Bombay and 4 in Ahmedabad. During the year no death was recorded from cholera in the collectorates of Ahmednagar Ratnágiri, Dhárwár, Rijápur, Kánara, Panch Maháls, and Sind was also entirely free. There were only 17 deaths during the year in the City of Bombay, and yet in the month of December the Turkish authorities placed Bombay in quarantine. The absurdity of such action will be manifest from a study of the distribution of the deaths.

Small-pox.

During 1886, the deaths from small-pox of 448 males and 428 females, or a total of 876 persons, were recorded against 2,646 in 1885, and a decennial mean of 7,841.

Small-pox, where present, was of a mild type. The highest ratio, 0·10 per 1,000, was recorded in Sind, against 0·22 in 1885, and a decennial mean of 0·23. In the Western Registration District it was 0·09, against 0·12 in the previous year, and 0·76 the decennial mean. In the Southern Registration District it was 0·06, against 0·32 in the previous year, and a decennial mean of 0·59. In Eastern Gujarat Registration District and Central Registration District the ratios per 1,000 of population were, respectively, 0·02 and 0·01 against 0·06 and 0·13, and the decennial mean of 0·34 and 0·39.

According to age, 26·37 per cent. of these deaths occurred among infants under 1 year of age, whilst 41·32 per cent. took place among children over 1 and under 12, the remaining 32·31 per cent. being among persons over that age.

In 44 towns, and in all the cantonments in the Presidency, no death from small-pox was registered during the year.

Fever.

During 1886, 146,986 males and 134,464 females, or a total of 281,450 persons, were reported to have died from fever, against 314,237 in 1885. The decrease, therefore, for the year under report, as compared with 1885, amounted to 32,787 deaths, whilst the mean for the previous 10 years is 282,220.

In the Sind Registration District fever caused a higher mortality (15·63 per 1,000) during the year than in 1885 (12·90). In the Eastern Gujarát Registration District, the fever death-rate fell from 25·97 in 1885 to 21·21, which is below the decennial mean of 22·42. In the Western Registration District the ratio was 17·35 against 18·96 in 1885, and 16·83 the decennial mean. In the Central Registration District the ratio was 16·64 against 20·06 in the previous year, and 16·50 the mean for the last 10 years. In the Southern Registration District the rate for the year, 14·54, was below the rate than in 1885, 16·14, and the mean, 18·44. The Collectorate of Broach heads the list with a millesimal rate of 26·08 against 32·35 in 1885, and 26·07 in the previous 10 years; and the following collectorates have also high rates:—Khándesh 22·90, Ahmedabad 20·76, Káira 20·62, Surat 20·48, Ahmednagar 20·11, Panch Maháls 20·11, Sátára 19·68, Sholápur 19·50, Thána 18·26, Násik 17·97, Hyderabad 17·60, and Kánara 17·33. The Presidency rate being 17·10 against 19·10 in the previous year, and 17·27 the decennial mean.

A comparison of death-rates in towns and cantonments with those of the zillas in which they are situated, shows that the highest death-rate from fever is reported from Viramgám, where it attained the enormously high rate of 30·70 per 1,000 of population against a zilla rate of 20·76. In the 13 towns and cantonments situated in nine different collectorates, viz., Sholápur and Bársi in the Sholápur Collectorate, Nadiád and Kapadvanj in Kaira, Dohad in the Panch Maháls, Ahmedabad and Viramgám in Ahmedabad, Karáchi and Hyderabad towns in the Collectorates of the same names, Umarkot in the Thar and Párkar, Shikárpur and Lárkhána in the Shikárpur Collectorate, and Jacobabad town and cantonment on the Upper Sind Frontier,—the death-rate from fever was higher than the average death-rate of the zilla.

Bowel-complaints.

During 1886, bowel-complaints caused the deaths of 20,275 males and of 16,337 females, or a total of 36,612 persons, against 45,056 in 1885 and a decennial mean of 36,093.

The Southern Registration District heads the list with the high ratio of 4·06 against 4·83 in 1885, and 3·72 the decennial mean. Gujarát comes next with a ratio of 2·36, and next to it is the Western Registration District, 2·31, and following is the Central

Registration District 1·99, and the last of all, Sind, with a rate of 0·21 per 1,000. In the Presidency the rate was 2·23, against 2·73 in the previous year, and a decennial mean of 2·21. All districts show a decrease in the death ratios. In collectorates the highest ratios were recorded in Dhárwár 5·43, Belgaum 5·04, and Khándesh 4·28, and the lowest 0·15 in Thar and Párkar and 0·14 in Hyderabad.

Injuries. During 1886, 3,297 males and 2,395 females, or a total of 5,692 persons met with violent deaths. The mortality from these causes exceeds by 115 that reported in 1885, when 5,577 deaths were recorded. Of the 5,692 deaths, 2,434 were caused by drowning, 1,164 resulted from snake-bites, 474 from wounds, 215 by hanging, 173 by poisoning, 85 from attacks by wild beasts, and 1,147 from causes not specified.

Other causes. The recorded deaths, from causes other than those specified, numbered 56,388, 29,045 of which occurred among males and 27,343 among females. The total for 1885 was 68,788; so far this year there is a decrease of 12,400.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1885–86 :—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1885–86.	1886–87.	Increase.	Decrease.	1885–86.	1886–87.	Increase.	Decrease.	1885–86.	1886–87.	Increase.	Decrease.
IN CIVIL LIFE.												
Itinerant	803,763	834,986	4,223 0·51	—	51,839	44,972	—	6,867 13·25	882,602	879,958	—	2,644 0·30
Dispensary	20,298	17,699	—	2,599 12·80	761	943	182 23·92	—	21,059	18,642	—	2,417 11·48
Total	851,061	852,685	4,223 0·50	2,599 0·31	52,600	45,915	182 0·35	6,867 13·06	903,661	898,600	—	5,061 0·55
IN ARMY LIFE.												
Native Army	3,120	2,970	—	150 4·81	681	1,618	937 144·93	—	3,801	4,588	787 20·71	—
British Army	206	317	111 5·39	—	122	405	283 248·36	—	328	722	394 120·12	—
Total	3,326	3,287	111 3·34	150 4·51	803	2,023	1,220 151·93	—	4,129	5,310	1,181 28·60	—
Total for the whole Presidency.	854,387	855,972	4,334 0·51	2,749 0·32	53,403	47,938	1,402 2·63	6,867 12·86	907,790	903,910	1,181 0·13	5,061 0·56

855,972 persons were primarily vaccinated, and 47,938 were re-vaccinated, against 854,387 and 53,403 in 1885–86, showing a net increase of 1,585, or 0·19 per cent., under primary vaccinations, and a net decrease of 5,465, or 10·23 per cent., under re-vaccinations. The rate of decrease in primary vaccinations was very high amongst dispensaries, being 12·80 per cent., and in re-vaccinations it was very high amongst the itinerant vaccinators, being 13·25 per cent. The highest decrease (11·48 per cent.) under total operations was amongst dispensaries. This decrease is due to the transfer of the vaccination work from the medical officers in charge of dispensaries to the táluka vaccinators, under the orders of the Government of Bombay in their Resolution No. 3,851, dated 1st November 1886. On the whole, there has been a slight decrease of 3,880; or, in other words, for every hundred persons operated on in 1885–86 the numbers for this year have been 99·57.

The following table shows, for the last two years, the number of infants successfully vaccinated in the Presidency *exclusive of Native States*. The birth and death statistics are taken for the calendar year in calculating the number available for vaccination, because infants are generally not vaccinated until three months after birth :—

Year.	Children Vaccinated successfully.		Children available for Vaccination.	Births returned as having been registered.	Deaths registered among Children under 1 year.
	Those under 1 year.	Those between 1 and 6 years.			
1885–86	363,519	151,424	471,822	572,431	100,609
1886–87	361,720	149,190	489,302	581,553	92,251

This year the successful vaccinations fell short of the registered births *minus* deaths amongst those under one year old. Out of 489,302 infants available for vaccination, 361,720, or 73·93 per cent., have been protected. Last year the percentage was 77·05.

Out of 855,972 persons primarily vaccinated, 817,386 cases were successful, or 95·49 per cent., being only 0·27 per cent. less than in 1885–86. The number of unsuccessful cases was less than that in the preceding year, being 15,703 against 15,891. 1,872 persons were operated on a second time on account of the failure of the first operation, and in 24,755, or in 2,201 cases more than in the year 1885–86, the result was unknown.

During the year, 47,938 persons were re-vaccinated, against 53,403 for 1885–86. In 50 instances the re-vaccinations were repeated, in 6,155 instances the results could not be ascertained, and in 10,888 the operations failed. The number of successful cases was 30,945, or 64·55 per cent., against 67·77 in the preceding year.

The total number of persons operated on was 903,910, and of these 848,331, or 93·85 per cent., were successful. In 1885–86 the percentage was 94·11. 1,922 persons were operated on more than once; the "unsuccessful" numbered 26,591, and the "unknown" cases were 30,910.

The ratio to the total population of protection by successful primary operations is higher than last year in all the districts and circles, except Cutch and the Central and Southern Registration Districts. It is lowest in Western Registration District and Presidency Circle. In British and Native Territory it is respectively 31·65 and 32·39 against 31·94 per 1,000 of population respectively in the previous year. On the whole, 31·91 persons of all ages per every 1,000 of population against 31·94 last year, 29·84 in 1884–85, 30·89 in 1883–84, 29·74 in 1882–83, and 27·54 in 1881–82, were primarily vaccinated successfully.

The age details are compiled for three periods, viz., under one year, between one and six, and above six years. The numbers under each period vaccinated were respectively 585,745, 258,205, and 12,022, against 587,894, 253,927, and 12,566 during the preceding year.

The quality of the lymph in use throughout the year was good. There were 5 separate consignments of English lympth, 2 of 45 tubes each, for the Bombay District and 3 for Aden. The first Bombay consignment produced better results than the second one.

Animal vaccination was carried on in Bombay, Poona City and Cantonment, and Rájkot. The operation of inoculating heifers was generally successful. In Western Gujarát, animal vaccination was, in the commencement of the cold weather, carried on in Rájkot by inoculating 7 out of 8 heifers successfully, and the lymph was distributed among the vaccinators. Except in Bombay, where animal lymph only is used, and in Poona and Rájkot, where both animal and human lymph were in use, vaccination in all other places was carried on from arm to arm and with human lymph. Vaccination with animal lymph was also carried on in Bándora.

Taking together the work of all the Deputy Sanitary Commissioners, Superintendents of Vaccination, Assistant Superintendents of Vaccination, and Inspectors of Sanitation and Vaccination, there were 4,235 encampments, 72,778¾ miles travelled in 7,942 days, and 323,136 children inspected in 13,225 villages. Out of every 100 persons operated on, 35·75 were this year inspected, against 34·72 in the preceding year.

Inoculation was not reported to have been practised anywhere in the districts, and no instances were reported of any other disease but cow-pox having been communicated through vaccination.

In Bombay the Compulsory Vaccination Act has been in force for nine years and in Karachi for seven years, and in both places there has been, since the introduction of the Act, a considerable increase in the number of infants protected.

Sanitary Works.

Military Works.

The actual outlay on military works amounted to Rs. 2,48,433 during the year 1886. Of this sum Rs. 1,18,203 were spent at Bombay and Colaba. At several other stations large sums were expended on work more or less connected with sanitation. At Devláli Rs. 45,252 were spent on military works. At Ahmedabad Rs. 8,509 were expended on various improvements.

Civil Works.

The total annual income of the municipalities during the year 1885-86 was Rs. 31,32,776, and the sum expended on conservancy by them was Rs. 3,38,763.

The population, annual income, and expenditure on conservancy in each Revenue Division will be found in the following table:—

Divisions.	Population.	Income.	Expenditure on Conservancy.	Divisions.	Population.	Income.	Expenditure on Conservancy.
		Rs.	Rs.			Rs.	Rs.
Northern Division	567,252	8,88,484	95,081	Southern Division	352,874	3,93,001	28,865
Central Division -	654,529	10,02,525	1,39,268	Sind Division -	325,187	8,48,766	75,549
				Grand Total	2,899,842	31,32,776	3,38,763

Water-supply.—The supply, which is ample, and of fairly good quality, is derived from rivers, tanks, and wells. Some of the municipal towns are mainly dependent on rivers for their drinking water-supply; and during the hot season, when the water becomes scanty, peons are temporarily employed to see that the water is not fouled; and when the rivers cease to flow, temporary wells are sunk in their beds. In Sind, canal water is used for drinking purposes in several towns.

Drainage.—No change since last year. In all municipal towns there are open masonry side drains in the main streets, but mere earth trenches in others to carry off rain water. There are no proper drains to carry of the kitchen and bath-room waste from private houses. In the Northern Division no drainage work of importance has been done in any of the municipal towns. At Ahmedabad, storm-water drains were repaired.

At Hyderabad the drainage and paving of the city is an urgent necessity. The services of Colonel Ducat, R.E., were lent by Government to the municipality for the purpose of preparing a sewerage scheme for the City. He has prepared a project which with minor connexions is estimated to cost about 3 lákhs of rupees. The municipality has approved of the scheme. Colonel Ducat, R.E., was also deputed by Government to visit Sukkur for the purpose of giving his advice in regard to improving the drainage system of that town. His report was approved by the municipality, and detailed plans and estimates are being prepared.

Cesspools.—There are but few municipal cesspools, but in nearly all towns most of the private houses have them, and the owners at necessary intervals see to their cleanliness at their own expense. At Viramgám some new cesspools have been built, there being 585 private and 2 municipal cesspools, against 483 in the previous year. In some other towns a few private cesspools have been built, but the construction of new ones is generally discouraged.

Scavengering.—The usual staff of sweepers is entertained by each municipality to keep the town and streets clean. Dust bins are provided in most towns in convenient spots, and emptied daily.

Latrines.—As observed last year, the larger number of municipal towns have public latrines, and private privies in some towns are cleaned by municipal sweepers. Night-soil from latrines is carted to depôts about a mile or two from the towns, and is either buried or converted into poudrette.

New works were carried out at several places during the year, details of which will be found at page 72 of the Sanitary Commissioner's Report.

Personal Proceedings and General Remarks.

In January I proceeded to Sind and visited Sukkur, where I met Colonel Ducat, R.E., the Consulting Sanitary Engineer to Government, who had been invited by the Municipal Commissioners to prepare a scheme for improving the water-supply and the sewerage of the town. I then went to Shikárpur and to Jacobabad, and on my return visited Hyderabad, where I again met Colonel Ducat, and consulted with him regarding the sewerage of the city, after which I visited Karáchi, and inspected the cantonment and town. March was passed in Bombay, but in April I went to Poona, where I stayed through the remainder of the hot weather, as I was anxious to see the condition of the city and the country between the canal and the river during the hottest season of the year. I stayed the rains in Poona and gave evidence before the Finance Commission, and also attended the Committee to consider the provisions of the Bill for promoting sanitation in villages. In November I came to Bombay, and in December, by order of Government, was associated with the Surgeon-General, Her Majesty's Forces, in investigating

the sanitary condition of Devláli and its vicinity. After the termination of this inquiry I went to Surat, and was there at the close of the year; but during my winter tour I inspected Broach, Nadiád, Viramgám, Ahmedabad, Sholápur, Bijápur, Gadag, and had reached Hubli, when I was recalled by telegram by Government in order to proceed to Khandva.

During 1886 the following regulations affecting or connected with the sanitation of the port were brought into force. By Government Resolution in the Judicial Department, No. '831, of 8th February 1886, Commanders of vessels entering the port are ordered to receive warning from the Port Trustees to clear out their bilges, and that in the event of accident arising from neglect of the warning, Government will prosecute the Commanders concerned.

By Government Resolution, General Department, No. 3,139, dated 30th September, it is ordered that a pilot on boarding an incoming vessel should receive a certificate signed by the master and medical officer, or, in the latter's absence, by the 1st officer, stating whether the vessel is free from infectious disease or not. This order, Dr. MacCartie says, has supplied a long-felt want.

By Government Resolution, General Department, No 4,056, dated 20th November 1886, and Government Resolution, No. 4,834, Military Department, dated 26th November 1886, it is directed that Pao Pir be considered the quarantine station for Bombay, and that the Ordnance Department should furnish any tents required in the fair season, and that, should necessity arise during the South-West Monsoon, special orders should be applied for.

Among the more important events of the year I must mention that the sanitary, or rather the insanitary, condition of the Ghorpuri barracks again was referred to me. I may perhaps be permitted to recall to recollection that, before the new barracks were built in 1877 at Ghorpuri, I brought, as strongly as I could, to notice my opinion that it was for sanitary reasons most undesirable to erect them on this site, which from its position would be always more or less malarious; and when it was determined, in spite of my remonstrances, that the barracks were to be built, I tried, but failed, to get the design altered to that recommended by the Army Sanitary Commission, which embodies all the recommendations made by the Royal Sanitary Commission for barracks in future to be built in India, and which is especially well adapted as a barrack for European soldiers serving in a tropical climate.

I need not here do more than mention how notoriously unhealthy these barracks have been ever since they were built. So bad a reputation did they obtain that at one time their permanent abandonment was, I believe, almost resolved upon; but in the commencement of this year I suggested that certain alterations could be made in them, and said that if one barrack was handed over to me, I could improve its sanitary condition. This suggestion met with the approval of General Gillespie, C.B., then Quarter-Master General of the Army, and Government were pleased by Government Resolution, Public Works Department, No. 77 M. W.-322, dated 26th February, to sanction the experiment being made.

I was informed that No. 5 new barrack, which occupies the most exposed position on the south-west of the Lines, had been the most unhealthy barrack, and I, therefore, selected it as the one in which the experiment should be tried.

The barrack consisted of one long room 166 feet × 24 feet, and was intended for the accommodation of 44 men. The sergeants' quarters are on the north side of the barrack. There were 11 doors on each side of the barrack room, besides a door at either end—that on the south opening into the verandah, and that on the north into the sergeants' quarters. The doors consisted of the usual glass and panelled door, 8 feet in height, with a revolving fanlight over each door, and high up under the eaves is a clerestory window. Ridge ventilation is also provided. The floors are paved with stone laid in cement, and there is a 3 feet plinth. A 12 feet verandah surrounds the barrack room on each side, except the north, which on the south and west sides was enclosed by venetians extending from the floor to the tie beam of the roof over the verandah. During the rains the venetians were kept permanently closed, and the men placed their dining tables at that season in the east verandah. The barrack room, when the venetians were closed, was extremely dark and gloomy, as no sun and comparatively but little light entered it, and the vault-like feeling in the barrack room has been complained of. If the doors were shut, and the revolving fanlights were kept open, currents of cold air blew down on the men whilst in bed, and the same thing happened if the clerestory windows were kept open, which, as a matter of fact, was rarely the case, as the men took every opportunity of closing them. There were no eaves, gutters, or downtakes, nor any provision for carrying away the storm water falling on the roof, which consequently soaked into the foundation.

Such was the barrack room when handed over to me. It stands on the most exposed position, with the race-course hill and maidán on the south and south-west. I had in 1877 proposed that the ground on which the new barracks were to be erected should be provided with sub-soil drains, but Government resolved that the execution of the work should be left for some future day.

It was impossible to alter the general design of the barrack, and I never professed to be able to convert it into a perfectly satisfactory building; but I thought some of the more glaring errors of construction could be improved, and in the recommendations I made, I tried to give effect, as far as circumstances admitted, to the instructions regarding barracks as laid down by the Army Sanitary Commission in their suggestions for improving Indian stations.

On receiving the above Government Resolution I made certain proposals which I was anxious should be carried out; but I was informed that some of them, such as the under drainage of the site, the provision of ventilation under the floors, &c., would be very costly, so that I was compelled to considerably modify my original proposals regarding the barrack.

Commencing with the outside, I must mention that no roof gutters were procurable in Bombay, so that they could not be fixed as I had suggested. As the next best alternative, a stone gutter has been laid all round the barrack, and led to a safe distance from it, and the ground between the plinth and this gutter has been paved at a steep pitch, so that rain falling on it will speedily be carried into the gutter.

The venetians have been entirely removed, according to the great sanitary principle laid down by the Army Sanitary Commission, that the air be allowed to play over as large a surface of the building as possible. There ought to be no impediment to the free entrance of the external air up to the wall of the barrack room, so that at all times, day and night, and whether it is raining or not, fresh air in abundance may be introduced into the room. Whereas if, as suggested by some, the lower half of the verandah outside the barrack room is enclosed by venetians, air and light and sun are shut out, and the framework of the venetians forms a resting place for dust and dirt to accumulate, and favors the growth of fungi, &c., and makes the place dark.

In lieu of the venetians, two wooden weather-boards or jhamps have been fixed, the upper one being in continuation of the verandah roof, and the lower one being placed half way down the verandah posts. The upper jhamp keeps the direct rays of the sun from striking into the verandah, and also protects it from rain, whilst the lower jhamp is intended to keep out the rain from the floor of the verandah; without it the rain would drift into the verandah. During the height of the monsoon some rain may perhaps on two or three occasions drizzle into the verandah, but should it do so the men will be no worse off in this barrack-room than they are now in each of the other new barracks where throughout the monsoon the tables are removed to the verandah on the east side which is entirely shut out from the south-west monsoon. The substitution of these jhamps for the venetians has thus enabled sun and light to be admitted into the barrack-room, whilst the men in the barrack have the great advantage of a cheerful look-out, and plenty of fresh air brought up to the wall of the barrack-room.

Another alteration was the closing of one of the steps on the south side and on the west, and the fixing of a porch over each of the steps on the west side. This was done in order to prevent, as now, the rain beating in, and keeping the floor of the verandah opposite each flight of steps permanently wet during the monsoon.

As regards the alterations carried out in the barrack-room, it was 166 feet long, has been divided by a central room into two rooms, each 82 feet long. This alteration was recommended in accordance with the following extract from the revised Suggestions of the Army Sanitary Commission:—

"The Royal Commission recommended that future barracks be built to accommodate not more than a quarter company per room, and that each block should consist of one single quarter company room, or, at the most, of two such rooms in line completely cut off from each other, with separate doors to the open air * * * * The sanitary principle, on which the construction of barracks in quarter company rooms is based, is that considerable sub-division in buildings is absolutely necessary for health in tropical countries. * * * * A separate barrack block would thus contain 24 men in one room, and one sergeant, or 48 men in two rooms, and two sergeants. Wherever the older class of barrack rooms still exists, or where large numbers of men occupy one room, or where the block is divided into rooms by walls with open arches, there is much greater risk during

epidemic seasons, especially when cholera is in the vicinity, than there would be if the rooms were sub-divided into smaller rooms, with separate entrances. Under the best attainable sanitary arrangements, simple agglomeration of men in numbers in one room, breathing a common atmosphere, is an epidemic disease cause. The only remedy in such cases is to sub-divide the rooms, providing separate entrances and separate ventilation for each sub-division, and to provide ventilation under the floor."

The last recommendation could not on account of expense, be carried out; but the sub-division of the rooms is strictly in accordance with the recommendation of the Army Sanitary Commission. It has been objected that this sub-division will make the room t; bt has noho utt his' been found to be the case, and the breeze has freer access into the building than it had before the venetians were removed.

The next alteration was the conversion of 6 of the 10 doors in each of the rooms into windows. The instructions of the Army Sanitary Commission are: "There " should be a window for every two beds * * * * five doors per room, two on " each side, and one at each end, will afford sufficient door space in a room for 24 men. " * * * * It is necessary to shield the beds nearest the door from air blasts " when the doors are kept open by thin partitions a few feet in height and 3 or " 4 feet in width. The window-sills should not be more than 2 feet or 2 feet 6 inches " above the floors, and the head of the window should be carried up to within a " foot or 18 inches of the ceiling." (This last recommendation could not be carried out, on account of the roof of the verandah being in the way.) "Every window should " consist of two parts; the upper portion, about 2 feet in depth, should be hinged " on its lower edge, and fall inwards, to form a species of louvre for ventilation. " on each side of the hinged portion should be a triangular cheek to prevent air " currents falling on the men. This louvred portion of the window should admit " of being easily closed by a rope or pulley. To whatever extent it is opened, air " currents will be directed towards the ceiling of the room. The lower portion " of the window should be a casement opening into two halves. The windows should " be 4 feet wide."

These are the directions, and the following is an account of what was done to give effect to them. Six of the doors in each room, three on either side, were converted into windows, leaving two doors, as directed, on either side, and an end door. The sill of each window is 2 feet above the floor. Each window consists of two parts. The upper portion, 1 foot 6 inches in depth, is hinged on its lower edge, to fall inwards so as to form a species of large louvre for ventilation. On each side of the hinged portion their is a triangular iron cheek, to prevent air currents falling upon the men. This hinged portion is opened and closed by a rope over a pulley. The lower portion of the window is a casement 4 feet square. It opens in two halves. The semicircular fanlights over each door and window are hinged on the lower edge so as to fall inwards, whilst an iron cheek on the sides prevents air currents falling on the men whilst in bed. These fanlights ought to be rectangular; but it was impossible, on account of the expense, to alter the original arches over the doors and windows.

The clerestory windows were likewise hinged on the lower edges, and made to fall inwards at an angle of 45°, their sides being protected to prevent air falling downwards, and so as to direct the air entering upwards towards the ceiling. Wooden screens have also been placed on either side of each door to prevent air currents blowing on to the men next to the doors when open.

I have thus endeavoured to carry out the instructions of the Army Sanitary Commission, who in their Memorandum on the Medical History of the European Troops in the Bombay Command for 1882 say: "There is distinct evidence that if movement " of air is set up outside, it passes over the men in bed, chills them, and induces " hepatic affections and fever attacks at some stations. The principal point to be " kept in view is that whenever cold currents of night air are allowed to fall on men " whilst in bed, there is more or less danger of chills, and hence the necessity of proper " ventilating arrangements in all such cases. The objection lies, not against ventila- " tion, but against cold air currents, which can always be prevented, while the " ventilation itself is not interfered with."

The alterations which have been carried out will, I hope, render an unhealthy barrack less unhealthy. Light and air have been admitted into it. It has been divided as recommended by the highest authority on the subject, and the ventilation has been improved by carrying out the great sanitary principal of *making it independent of doors*

and windows, so that it is now possible to let in abundance of fresh air at all hours of the day and night into the barrack without causing draught, whilst measures have been taken to protect the men from chill. It was not possible to correct all the original mistakes of construction, such as having the sergeants' room at one end instead of in the centre of the building. The height of the windows could not be increased, nor could ventilation under the floors be provided, or any means taken for preventing moisture arising from the sub-soil, except by preventing the roof water soaking into it. The total cost of these alterations amounted to Rs. 7,618-9-10.

In order to have a more perfect demonstration and trial of the system, I was anxious to have No. 4 Infantry barracks at Mhow, and one of the Napier Barracks at Karáchi altered in the same way.

The Napier Barracks at Karáchi have for many years past had an unenviable notoriety for unhealthiness, and this fact is year by year persistently brought to notice by the Army Sanitary Commission in their annual Memorandum on the health of the British troops in the Bombay Command. The question I asked myself is, can nothing be done to improve the sanitary condition of these barracks? Are the men in them to be left, year by year, to become inefficient as soldiers, when the sanitary condition of the barracks can be improved at a moderate cost?

Each of the upper-storied Napier Barracks is 277 feet long, or nearly three times as long as it should be, and more adapted for a shooting gallery than for a barrack. Each room on the upper floor contains 66 men instead of 24, the unit fixed by the Royal Commission for a barrack room. I pointed out that the advice of the Army Sanitary Commission is peculiarly applicable to these barracks, and I recommended that this long upper-storied room should be converted into three rooms by building two partition walls, and that all but two doors on each side of each room should be converted into windows, and that, if the construction admits of it, that the door and windows recommended by the Army Sanitary Commission should be fixed, and, if not, that an adaptation, similar to that carried out at No. 5 barrack at Ghorpuri, should be made.

I pointed out to Government that much of the disease attacking the men in these barracks was due, in my opinion, to the infraction of the great sanitary principle of the ventilation being independent of doors and windows. The barracks are very draughty, and it is impossible, in present circumstances, to ventilate them properly.

Government, however, ruled that it was better to wait to see the result of the experiment in the barrack at Ghorpuri. I was sorry for this resolution, as I feel confident that the advice I gave was sound, and would, if carried out, have a very potential effect in reducing the sickness among men at Karáchi.

The question of efficient ventilation in India has a much wider aspect than merely its application to barracks. From the experience gained in 33 years' service, nearly 29 of which have been passed in the country, I am firmly and fully convinced that more than half the illness Europeans suffer from in this country is the result of chill, and this is largely to be ascribed to the very faulty and unscientific means of ventilation employed in the usual Indian bungalow. By the most extraordinary arrangement, Europeans in this country have adopted the same kind of bungalow from Cape Comorin to Peshawar. It is as if there should be only one design for a house between London and Brindisi, as if there were not different climates to be met with in this vast continent. A house which would suit the hot and sultry climate of Hyderabad in Sind would not be suitable for the coast climate of Karáchi, where there is always a strong sea breeze blowing. The dry climate of the Deccan differs essentially from the hot, moist climate of Gujarát; yet, as in the case of barracks, there is one standard design for bungalows. All have numerous doors opening out of sitting rooms and bed rooms, and there are but few windows, and even where there are windows, they cannot be opened without admitting a current of cold air on the level in which the occupant of the rooms is either sitting or whilst in bed.

The great sanitary principle of making the *ventilation independent of doors and windows, has been forgotten*, and not acted up to, and people in India will continue to suffer from fever, liver-complaints, &c., to a much greater degree than they would do if only common-sense would induce them to carry out the first great sanitary law regarding ventilation.

The Dutch, two hundred years ago, were wiser, as shown in the old Dutch Factory, now the travellers' bungalow, at Surat. When the windows and doors are shut, by keeping the upper window open, plenty of air is admitted into the room without

blowing directly on to its occupant. It is to be much wished that this system of ventilation were generally introduced into private houses as well as into barracks throughout India, as I am quite confident no measure would tend to promote the health and comfort of the European residents to a greater degree, and it is a subject I would especially recommend to the notice of architects.

I hope, also, these remarks will attract the attention of sanitarians in England, so as to raise the question whether barracks should be built in India according to standard plans, which, irrespective of the varying conditions of climate, are made applicable to the whole continent of India; and I hope, also, the designs of the standard plans, which are in use in India, will be examined by experts in England. For my part, I entirely condemn them, and maintain that they are full of sanitary errors. It seems very hard that in no single instance, as far as I am aware, has a barrack been built according to the design published by the Army Sanitary Commission in their Suggestions. Its superiority over the standard plans, which obtain in India, is manifest to any one who knows anything about sanitary science and requirements, and I can conceive no subject which more intimately affects the health of the European Army in India. Sanitary science has made great strides since the date when these standard plans were drawn up, and experience has shown them to be faulty, and not to embody the fundamental sanitary principles which must be observed to ensure healthy buildings. I would, therefore, hope that the whole subject may be considered, and that, at all events, a trial may be made by building a few barracks according to the design given in the revised Suggestions of the Army Sanitary Commission.

During the year the Committee appointed by Government in its Resolution No. 1154, dated 29th March 1886, assembled at Poona to consider the Draft Bill regarding village conservancy prepared by the Remembrancer of Legal Affairs, and submitted a report to Government. As the provisions of the Bill have not as yet been made public, I do not feel at liberty to discuss the question in this report further than to say that I most earnestly hope that a proposal which was made to the Committee, that the Village Conservancy Act should be restricted to villages containing not less than 500 inhabitants, will not be sanctioned by Government; for out of 24,578 total villages in the Presidency, there are 8,997 containing above 500 inhabitants, and as the figures include 55 towns it will be seen that the Act would, if applied to the remainder, be enforced only to a very limited extent, and that the great majority of villages in this Presidency, *viz.*, 15,601, would not be included in its operations.

Disease is not confined to the large villages, and cleaning operations are as essential in small villages as in those containing a population of above 500 inhabitants; and the Act, if restricted to the latter, would be perfectly useless in arresting the ravages of epidemic disease, such as cholera.

If it is found absolutely necessary to restrict the operation of the Act, I suggest, for consideration, the advisability of classifying the villages into three classes:—

1. Those containing above 500 inhabitants.
2. Do. do. between 200 and 500 inhabitants.
3. Do. do. below 200 inhabitants.

To villages in the 1st class, strict conservancy rules might be applied; to those in the 2nd class, less stringent ones; and to those in the 3rd class, simple provision made for the protection of the drinking water-supply, the allottment of places to which alone the villagers should be allowed to resort for natural purposes, and the enforcement of cleanliness of surface around habitations.

I quite recognize the difficulties in the way of introducing such a measure, and that, whatever course is decided upon, it must be for some years tenative; but I hope an endeavour will be made to embrace all villages. What is required is *simple cleanliness*, and the attainment of this object is, in my opinion, not beyond just demands.

I must here notice the powerful support which this most important subject of village sanitation has received from Miss Nightingale, who in a most able letter addressed to the Joint Secretaries, Bombay Presidency Association, Bombay, and to the Poona Sarvajanik Sabha has shown how much may be done by the people themselves in assisting Government in this matter by influencing public opinion among their fellow-countrymen, and showing them the benefits to be derived from carrying out measures which have for their object improved health, and, therefore, greater happiness among the rural population of this Presidency.

In obedience to the instructions conveyed in Government Resolution, General Department, No. 3,497, dated 26th October 1886, there will be found in the Appendix

a tabular statement embodying information, under the heads of "Drainage," "Water," and "Domestic Cleansing," as to the sanitary estimate of towns and villages inspected by the Deputy Sanitary Commissioners and Civil Surgeons during their tour..

The water-supply throughout the Presidency may be described as being generally of fair quality, though at all times and in too many places liable to contamination from surface filth. If it is derived from flowing streams, or from holes dug during fine weather in the bed of rivers, the greatest care is necessary to prevent any impurity from the village itself finding its way into the stream. All washing of clothes, watering cattle, burning of bodies, &c., &c., should be rigorously forbidden up stream; and the practice introduced during the late famine at the relief camps, by many engineers, of building a ramp of sand, the top of which was defended by bramble bushes, across the bed of the river above and below that part of the bed from which the drinking water was drawn, might, with but little expenditure of labour, be advantageously followed in very many villages which are situated on the banks of rivers and streams, and which are dependent on them for their water-supply.

In my opinion, the use of tank water for drinking purposes by human beings ought to be absolutely forbidden. If a tank is the only source of drinking water, it is always possible to construct a well near its margin so as to ensure a certain amount of filtration through the soil. It is not, in my opinion, safe to drink the water from a reservoir constructed at some distance from a town until it has been filtered, and I think filter-beds should form part of every water-supply scheme devised by officers of the Irrigation Department.

I have already stated my opinion that all wells should be domed over, so as to protect the water from the action of sunlight and from air-borne impurity finding its way into the water. There is also much need for a well being especially set apart for the low-caste people in every village. In very many parts of the country this is done; but in villages where there is only one well, they are often put to great straits for their drinking water.

I anticipate that the register of water-supply lately introduced by the Director of Agriculture will have the effect of drawing attention to the wants of the low-caste people in this matter, and thus benefit the rural population of the Presidency to a very great extent. District officers always do what they can to preserve the purity of the water-supply throughout the country; but until the people are more educated, and are systematically taught the danger of polluting the sources of their drinking water, much advance without legislation cannot, I fear, be expected in this direction.

As regards drainage, there are, in most villages, no drains of any description, and the storm-water flows off or stagnates according to the level of the site. In a few of the main streets of the better class of villages there are open roadside gutters, but no town or village has any proper system of sewers.

As regards domestic cleansing, some attempt is made, in municipal towns, to enforce surface cleanliness; but in villages, where there is no establishment of any kind, all filth remains untouched until the villagers hear of the approach of some district officer, when a hasty attempt is made to clean up the main streets; but the back slums are never cleaned, and the filth in and around houses is seldom or ever removed.

I have, as usual, in bringing this, the last annual report I shall write as Sanitary Commissioner, to a conclusion, the pleasing duty of bringing prominently to the notice of Government the aid which I have received from the officers of the Department, who have one and all during the year worked well, and exhibited zeal and devotion in the performance of their respective duties.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1886-87.

(*Mr. H. J. S. Cotton, Officiating Chairman.*)

The usual allotment of a lakh and a half of rupees was made for the cleansing and structural improvement of bustees; of this amount, Rs. 75,801 were absorbed in establishments. A sum of Rs. 74,199 only was available for improvements, and as this expenditure was altogether inadequate for the magnitude and variety of the works in hand, the Commissioners voted an additional grant of Rs. 1,75,000 out of the capital loan of 17½ lakhs which was raised during the year. The total sum sanctioned for structural improvements was, therefore, Rs. 2,49,199. The expenditure actually incurred was Rs. 1,53,974 3a. 6p.

The improvement of the following bustees has been completed by the Corporation during the present and previous years:—

(1.) Soortee Bagan Bustee.
(2.) Patwar Bagan do.
(3.) Jorapuker and Goalapara Bustee.
(4.) Bamun Bagan do.
(5.) Kola Bagan do.
(6.) Nather Bagan do.
(7.) Colvin's do.
(8.) Pathuriaghatta do.
(9.) Kalaker do.
(10.) Foolbagan Bustee.
(11.) Dorponarain Tagore's Bustee No. 1
(12.) Lal Bagan Bustee.
(13.) Kristo Bagan do.
(14.) Parsee Bagan do.
(15.) Kaloo Ghose's Bagan Bustee.
(16.) Jorabagan do. (Sec. 283-A.)

The following statement shows the stages at which the bustees under the provisions of Sections 280 to 283 stood at the close of the year:—

Improvements nearly completed.

(1.) Soorhatta Bustee.
(2.) Keranee Bagan Bustee.
(3.) Durmahatta Bustee.
(4.) Sickdarpara do.

Improvements commenced.

(5.) Ooryapara Bustee.
(6.) Fokeer Chand Mitter's Bustee.
(7.) Goabagan do.
(8.) Sova Bazar Bustee.
(9.) Shaikpara do. (Sec. 283-A.)

Projects finally approved, but works not commenced.

(10.) Hanspukur Bustee.
(11.) Moydaputty do.
(12.) Puchagully do.
(13.) Moydatolee Bustee.
(14.) Machooa Bazar do.

Orders issued to draw up the draft projects.

(15) Rajbullubpara Bustee.

Orders issued to revisit the bustees, under Section 280, by the medical officers, with a request to modify their first reports.

(16.) Bustee north of Manick Bose's Ghat Street.
(17.) Bustee south of Manick Bose's Ghat Street.

Orders issued to inspect the bustees, under Section 280.

(18.) Bustee north of Baug Bazar Street to be inspected after the drainage improvements have been completed.
(19.) Blocks of bustees in Hastings.

Improvements ordered to be postponed.

(20.) Gangooly's Lane Bustee.

Improvements not necessary.

(21.) Durponarain Tagore's Bustee No. 2.

(22.) Kobirajpara Bustee.

Report of the medical officers before the Committee.

(23.) Moonsheetalao Bustee.

The foregoing account will illustrate the considerable progress which is being made by the Corporation in improving the bustees of Calcutta. The work is tedious, because many interests are involved, and it is necessary to hear patiently the objections which are in almost all cases brought forward by the owners of the land. Summary action is not allowed in any case, and as the Commissioners hear all objections themselves in Committee in the presence of the objectors, all risks of injustice is obviated. The expense incurred by the Corporation up to date in carrying on these improvements is very great, but it is more then compensated by the benefits which the town has received.

Tank filling and Bathing Platforms.—Nine tanks have been filled up by the Corporation during the year and seven by the owners: besides the above, 11 tanks were being filled up by the Corporation and 11 by the owners at the end of the year. Four tanks have also been dewatered, which will be filled up during the current year. The owners have dewatered and improved 12 tanks during the year under report. The site of Blacquire's tank in ward No. 3 was being filled up at the close of the year. This tank is municipal property, and its site is being converted into a public square at a cost of Rs. 14,357.

At the beginning of the year 41 bathing platforms were in working order. Great efforts were made during the year 1886–87 to increase the number to 75, but the difficulties and delays inseparable from land acquisition prevented this being done. Many sites which had been approved were abandoned and others chosen. The state of things at the close of the year was as follows:—

(*a.*) Number completed and connected with piping and actually working	69
(*b.*) Connected just after the close of the year	2
(*c.*) Completed but not connected with piping	2
(*d.*) Sites obtained and platforms under construction	5
(*e.*) Sites in course of acquisition, possession expected shortly	2
(*f.*) Sites selected, but declarations not yet submitted to Government	2
(*g.*) Sites abandoned	2

Thus it will be seen that 78 platforms are nearly completed, or on the eve of completion, and in two more cases, the possession of the site is immediately expected.

These bathing platforms are very popular, and are most largely used. Nearly all of them are double with separate apartments for women. The proposal to construct these public baths emanated in the first instance from the municipality, and the realisation of the scheme has conferred a boon greatly appreciated by the poor of Calcutta. It will be necessary to increase the number of these platforms gradually as more tanks are filled up. It has always been proposed to supply them with filtered water as soon as a supply is available, and this, no doubt, will further increase their popularity.

Street Improvements.—The street improvement grant from revenue was as usual Rs. 30,000. This is for petty improvements; all larger and more important constructions are undertaken from the drainage budget. These improvements are, of course, also independent of all works carried out as bustee improvements. The expenditure incurred on this account was Rs. 43,065-1-5, or Rs. 13,065-1-5 in excess of the grant. This excess is due principally to adjustments of accounts: expenditure which had really been incurred in previous years, was actually disbursed in 1886–87. The work done was not more than usual.

Water Works.—The new 48-inch main was in operation uninterruptedly throughout the year. It has worked very satisfactorily, and occasionally when the 42-inch main was under repair, the whole supply of Calcutta has been received through this source.

In consequence of the improved facility of communication, the supply of water into Calcutta has increased, and the daily average last year was 9,112,648 gallons against 8,083,698 gallons in the preceding year. This supply represents 22½ gallons per head against 20 gallons. During the hot months of May and June, when the demand for water was greatest, the supply reached 24 and 25 gallons per head of the population. During May 1887, the supply was so far increased as to average over 11 million gallons, and to occasionally exceed 12 million gallons a day. This is due to an increase in the working filter power at Pulta.

It must, however, be clearly understood that the full amount of the increase expected from the new works under construction can only be received when those works are completed. The new main is an essential preliminary to the increase of the water supply, but it is only the channel through which the increased supply will come. In order to obtain the additional supply, to raise the daily supply of water in Calcutta from 8 to 20 million gallons, it is necessary to construct entirely new works at Pulta. The existing machinery is insufficient. New engines have had to be purchased, and set up in a new engine-house to be built for the purpose, a new workshop, a new coal-house, and a new residence for the engineers in charge have had to be built, a new screw pile-jetty to facilitate the landing of material has had to be set in the river, a large additional tract of land has had to be acquired and cleared, two vast settling tanks, each more than 2,000 feet in length and 230 feet in breadth, have to be excavated, 24 new filters, of which 16 have at present been sanctioned, are required, a suction main has to be laid, and pipes have to be laid down to connect the filters and the tanks. All this work which had previously been sanctioned, has progressed during the year, and details are given in the Engineer's report.

The completion of these works is necessary to send the additional supply of water to Calcutta.

Other large works are necessary to distribute the supply when received. The existing machinery in Calcutta is as insufficient for such a purpose, as the existing machinery at Pulta is to supply the water. The engines and boilers at Tallah are, therefore, being replaced, and an entirely new engine-house with a large reservoir to contain 4 million gallons is being constructed on the land recently acquired by the Corporation in Halliday Street. These Halliday Street works are of the greatest importance. It is impossible that the whole town can be adequately supplied with water from the existing engines at Tallah and Wellington Square. The more distant localities can only receive a scanty supply attenuated by the discharge of water at thousands of intermediate outlets. Even an increase of pressure will not remove this difficulty. The only remedy is the construction of a central pumping station with a suitable reservoir. This has now been sanctioned, and the works are all well in hand. But it is only when the Halliday Street Station is completed, that the present deficiency of water in Burra Bazar and the other riparian wards of the town can be remedied. The greater quantity of water already coming into the town has relieved this deficiency to some extent, but it can only be adequately met by improvements in distributing the water. For this purpose new series of pipes have to be laid, and are now being put in position.

Of the increased supply of water into Calcutta, it has always been estimated that 2-million gallons (afterwards to be increased to 4 millions) will be available for the suburbs. For this reason a larger main was laid than the necessities of the town required, and the Suburban Municipality undertook to pay the interest on the additional expenditure incurred on this account. This interest has, however, not yet been paid; nor have the suburban authorities yet taken any steps to enable the town water to be laid on to the suburbs. It was explained in last year's report that the system devised for suburban distribution was to have three raised reservoirs, each 30 feet high, which would receive water by night from the Wellington Square station and distribute it by gravitation during the day.

Hand by hand with the extension of the filtered water-supply, the supply of unfiltered water has also increased. The daily average supply in the past year was 1,868,572 gallons against 1,670,941 gallons in the year previous. During the current year the daily supply has averaged over 2½ million gallons. The supply is pumped up from the river at Mullick's Ghat near the Hooghly Bridge, where there are two engines which put on a pressure of 150 feet, and are capable of raising and delivering 5-million gallons in 12 hours. The limit of extension is the present insufficiency of water-pipes. To improve the piping the Commissioners sanctioned on the 20th May 1886 an estimate amounting to Rs. 3,71,592. Thirty-three miles are already piped: the extension will add 31 more miles to this, and the work is now being actively pressed on.

Until a very recent period it was found necessary to use a certain quantity of filtered water for watering the roads, flushing latrines, &c., but now none other than unfiltered water is used for such purposes.

Drainage.—Three special drainage works have been undertaken during the year—the drainage of Hastings, the drainage of the Baug Bazar area, and the sewering of a portion of the Mahratta Ditch. The extension of the drainage system to Hastings was sanctioned during the year 1884–85. The work was commenced immediately after the rains of 1885, and the sewering is now complete. The total length in lineal feet of sewers and pipes is three miles, besides the connecting brick-sewer to the town system which is 2,800 feet long by 3 feet in diameter. The cost of the whole work, including flushing arrangements, is about Rs. 89,000. The scheme provides flushing chambers of from 250 to 400 gallons capacity at each of the pipe sewer-summits, and a flushing reservoir holding 25,000 gallons at the head of the 3 feet culvert connecting Hastings with the "main receiving sewer" in Circular Road. The water for this purpose is temporarily supplied by a portable engine and pump erected on the bank of the Tolly's Nullah: since the close of the year a permanent engine has been erected.

In the Baug Bazar area pipe sewers have been laid in existing roads, but the bulk of the work still waits on land acquisition.

The sewering of a portion of the Mahratta Ditch forms part of the scheme for draining the portion of the suburbs between Circular Road and the Circular Canal. The work was, however, undertaken for the immediate purpose of acquiring storage ground for earth for tank-filling obtained through the Port Commissioners from the Kidderpore Docks.

The total length of public sewers constructed during the year was 12,651 feet, or 2·39 miles. In addition to these sewers in public streets, 9,834 feet, or 1·82 miles, of sewers were constructed in bustee roads, and sewers relaid and repaired amounted to 9,069 feet, or 1·71 miles. As usual the laying of pipe sewers along open ditches was followed by their being metalled and converted into footpaths. The value of the work done by the Department in this respect can only be appreciated by those who knew the state of Calcutta in former times; but an inspection of the ditches or "elongated cesspools" of the suburbs will give some idea of the improvement effected in Calcutta. The total length of these sewered passages in Calcutta is now 34 miles.

Under Section 27 (*a*) of the Act the Corporation are required to spend 1½ lakhs annually on drainage works. The expenditure during the past year was Rs. 1,46,084. The expenditure inevitably becomes less, as the drainage works are approaching completion. If an average of the past six years is taken, the expenditure far exceeds the required amount. The figures were given in last year's report. Including the year under review, the average will be Rs. 1,88,755.

Due attention has been paid to the importance of flushing the drains. The extension of the unfiltered water-supply has afforded increased facilities for this purpose; 26 flushing wells have been constructed at or near the summit of public sewers during the year; 52 wells previously constructed have been deepened. A very beneficial effect has been produced by the construction of a flushing chamber of 2,000 gallons capacity at the summit of No. 9-inch sewer in Mooktaram Baboo's Street. The excellent flushing arrangements at Hastings have already been referred to. The Commissioners are much impressed with the necessity of improving the flushing operations in all parts of the town, and lose no opportunity of supporting the Engineer's action in this respect.

The number of premises connected with the sewers during the year was 1,090, and the total number connected is now 23,572. Privy connexions have been freely sanctioned in all cases where the adjoining sewers are properly flushed. The inspection of premises by the Drainage Inspectors has again been actively carried on: the number of inspections was 5,639 against 5,347 in the preceding year.

Roads and Conservancy.—The length of roads in Calcutta is now, stone metalled 72 miles and brick metalled 72 miles, or 144 miles altogether; 29 miles of road are 32 feet wide and upwards, 59 miles are from 15 to 32 feet, 39 miles are from 9 to 15 feet, and 17 miles are under 9 feet in width. In addition to this the roads over sewered ditches are 34 miles in length. The total cost of road repairs in the year was Rs. 2,02,082. There are four steam rollers belonging to the municipality.

The length of roads watered is 90½ miles. The watering of all the streets on the authorised list was regularly attended to during the dry months, and whenever

necessary during the wet months. When the pipe extensions are completed, the street watering in the north of the town which is now insufficient, will be improved, and the streets watered in a more satisfactory manner.

In accordance with the new rules the conservancy carts now work twice a day in the northern division of the town. The daily average number of carts actually at work during the year was 377. The number of waggon-loads of refuse despatched to the Salt Water Lakes was 14,472, an amount which exceeds that recorded in any previous year. During 1885–86 the number was 13,525. These figures do not include road scrapings, nor the road-detritus removed from sewers and gully-pits, nor the amount of refuse utilised in filling up tanks. The increase in the past year is in some measure owing to the fact that nearly all the refuse from the southern division had to be sent out of town, in consequence of the few tanks available for filling. The weight of refuse carried in one waggon is about 10 tons. The difficulty of unloading refuse from the waggons and spreading it over the land during the rainy season is very great. During the year the penalty for detention was enforced in respect of 731 waggons. It is obvious that any delay in clearing waggons at the Salt Water Lakes reacts with serious effect on the whole conservancy arrangements of the town. Assistance can be afforded to the contractor by opening out additional branch lines, and this is now being done.

The work of obliterating foul and unwholesome tanks was prosecuted with vigour: 54 tanks were under operation, a larger number than in any previous year. Of these 54 tanks 16 have been completely filled up, 22 were in process of filling at the close of the year, and 16 have been de-watered.

Since the close of the year the supervision of the Conservancy Department has been transferred from the Engineer to the Health Officer.

Sanitation.—Dr. Simpson, the full-time Health Officer of the Corporation, took charge of his duties on the 15th May 1886. The interesting and able report which he has submitted (*see* p. 130) is, therefore, the first of his incumbency. The report is for the calendar year 1886.

The concluding pages of Dr. Simpson's report are devoted to various suggestions regarding the sanitary administration of the town. His well known views regarding the registration of vital statistics are repeated. On this head the Commissioners think it sufficient to say that they concur with the following remarks recorded on the subject by the Select Committee on the new Calcutta Municipal Bill.

"The chapter regarding the registration of births and deaths has engaged our special attention, but we have not been able to make any improvements on the existing system. Dr. Simpson, who gave us the benefit of his advice on all the sanitary portions of the Bill, desires to see registration of deaths at the registrars' offices made compulsory, instead of at the office of the Registrar or with the Sub-Registrar at the burning or burial ground as at present. It seems to us that, to be effective, registration with the Registrar must be made a condition precedent to interment or cremation, and this we are not prepared to recommend. The inconvenience which would be caused by keeping a corpse unburnt or uninterred, because the death had not been duly registered, would be extreme, and we cannot advocate this. On the other hand, to make registration at the Registrar's office obligatory after the cremation or interment would be no practical improvement on the existing system. We think the existing system, if intelligently worked, should suffice to secure accuracy so far as deaths are concerned, especially after the limits of the town have been extended. As regards the causation of death, the present system is avowedly inaccurate, and we have accepted Dr. Simpson's proposal to make it obligatory on all medical men attending cases which terminate fatally to certify the cause of death."

The Commissioners agree with the Health Officer and the Select Committee on the Bill that a medical certificate of the cause of death should be insisted on in the case of all persons who have received medical attendance.

It is understood, however, that the cause of death is not always registered with scientific accuracy even in European countries, and that in the principal towns of Scotland the margin of uncertainty is usually not less than 14 per cent. In Calcutta the error is not much more than this. The Commissioners cannot approve of the reference in this paragraph to the discharge of the medical inspectors who were temorarily employed on occasion of the late cholera outbreak. These officers were temporarily employed, as already explained, for a special purpose; and it was never intended by the Commissioners that they should be retained for the registration of sanitary statistics. It is only the certificate of a medical attendant, not of a medical

inspector investigating the locality after disease has broken out, which can satisfactorily remove doubt as to the cause of death.

Dr. Simpson's observations on the need of building regulations deserve full consideration. This subject has, however, also been discussed by the Select Committee on the Bill, who had the advantage of hearing all that the Health Society and Dr. Simpson had to lay before them on the subject. It is proposed in the new Bill to materially increase the powers of the Commissioners, and to authorise them to require the owner of bustee land which he proposes to let out for huts to send in a plan showing how future huts are to be built before they sanction any one hut being erected. This, however, appears to the Health Officer to be insufficient, and the Commissioners have directed that the sections of Dr. Simpson's report which bear on the subject should be placed before the Committee which has been appointed for the consideration of the amended Bill.

The Health Officer again raises the question of the disposal of the refuse and night-soil of the city by burning. This is a most important matter, and the Commissioners will await with interest the special report which has been promised on the subject. The present arrangements of conveying the refuse to the Salt Water Lake work satisfactorily during the dry season for the year, but during the rains the difficulty of emptying the waggons enormously increases, and in consequence at the very time of year when it is most necessary that the conservancy of the town should be scrupulously attended to, it unavoidably falls into arrears. The only remedy for this is the provision of additional waggons and locomotives. Five additional waggons which have been sanctioned during the present year, are under construction, and an additional engine, which has also been sanctioned, is immediately expected from England. But the Commissioners hesitate to sanction any considerable further outlay in this direction when there is reason to believe that a change of system in the disposal of the refuse may render the maintenance of rolling stock no longer necessary.

The proposal of the Health Officer for filling tanks with earth conveyed from the Salt Water Lakes could only be given effect to, if the supply of surplus waggons were very much larger than it is at present. It is doubtful, also, whether it would result in any real economy. The Municipality now obtains earth from the dock works at Kidderpore in trucks which are connected with the Municipal Railway, but the cost of this arrangement is so high as to be prohibitive except in special cases.

The elaborate separate note which has been recorded by Dr. Simpson on the distribution of cholera in Calcutta (*see* p. 138), calls for some notice from the Commissioners. The statistics are most valuable: dividing the 20 years from 1865 to 1886 into four quinquennial periods, they show an average mortality during each period as follows:—

——	No. of Deaths.	Ratio per 1,000.
From 1866 to 1870	18,422	8·5
„ 1871 to 1875	5,922	2·7
„ 1876 to 1880	6,598	3·0
„ 1881 to 1885	9,845	4·5
In 1886	1,741	4·0

The water-supply of Calcutta was introduced in 1870, and it has always been recognised as a remakable phenomenon that that year was signalised by a great decrease in the cholera mortality. The ratio of deaths in 1869 was 8·2, in 1870 it was 3·5, and it 1871, it sank to the lowest rate on record, 1·8. That the water-supply affected the mortality there can be no doubt, but it would appear an unjustifiable assumption to attribute the whole of the marked improvement in the health of the town to the supply of pure water. In the first place, the improvement had begun to manifest itself before the water was supplied. The supply dates from May 1870.* The cholera deaths during the last six months of 1869 were only 359, whereas the average number during the same period, since the water-supply has been introduced, is 486. The deaths during the first four months of the year 1870 were 1,068, or lower than in any year preceding the introduction of the water-supply and lower than in many years since. In the second place, the water-supply was at first very scant: in 1870 it was

* This is the date on which the justices took over the water works. From the 18th November 1869 a tolerably continuous supply of water was brought into the city by the contractors. The amount was then about three million gallons a day, and was mostly used, as the reports show, for filling public tanks and watering the streets. It also found its way into use through the standposts, but there were at that time no house connections.

only three million gallons a day; in 1871 it was four million gallons a day. At the present time we find that ten million gallons a day is quite insufficient, and it cannot be pretended that the diffusion in the town of so small an allowance as three or four million gallons, was the real cause of the improvement in the health of the town which accompanied the introduction of the filtered supply. There were other causes at work of wider influence.

The object of Dr. Simpson's memorandum is to discuss the circumstances and conditions under which the incidence of cholera fluctuated in Calcutta during the quinquennial periods specified, and he summarises the reasons for the tendency towards an increase of mortality in the following words:—

"The three factors simultaneously at work during the past few years, have been as follows:—

"(1.) A scarcity of water, specially in the riparian wards. The scarcity, however, has in some degree become general throughout the town.

"(2.) A system of underground drainage has been extended into narrow streets without sufficient provision for its flushing and cleansing.

"(3.) Inefficient conservancy and nuisance removal."

"Following closely on the track of these changes and in the localities where these insanitary conditions are most intense, a recrudescence of cholera has taken place. There may be other influences at work to which I shall at a future time refer, but certainly the three mentioned above are the most striking and most frequent conditions discoverable in the worst cholera dens."

The Commissioners cannot accept this explanation without considerable modification. They are entirely at one with the Health Officer in their conviction that among the most urgent needs for the improved sanitation of the town are the extension of the water-supply, the greater regularity in flushing the drains and sewers, and greater efficiency in the administration of the Conservancy and Nuisance Department. But they must point out that Dr. Simpson is in error in assuming that in any of these particulars there has been retrogression on the part of the Corporation. On the contrary, there has been steady and progressive improvement, and this improvement was categorically recognised by the Sanitary Commission appointed by Government in 1884.

There are many passages in Dr. Simpson's memorandum which show that he is under the impression that filtered water is now obtained by the public with more difficulty than formerly. After referring to Burra Bazar he writes in page 5 of his Memorandum:—"Scarcity is not, however, confined to the riparian wards, though "they probably suffer most severely. A general change over the greater part of the "town has gradually taken place within the last few years, and even the southern "districts suffer." And generally throughout his note he assumes that the water scarcity is increasing. The Commissioners need hardly assure the Government that the direct contrary is the case. The report of the Engineer will show that the water-supply in Calcutta has been steadily augmenting year by year, and during the past year, 1886, the supply averaged a million gallons a day in excess of the maximum previously supplied. During the current year another million gallons a day has been added. The Commissioners themselves are in the best position to know that there is no scarcity of water now in Calcutta which was not much worse in previous years. If the pressure is somewhat lower than it formerly was, this fact is easily explained by the greater number of connexions which have been established. It is impossible to keep up the same pressure when the water passes away from 10,000 outlets as when there were only half the number. But the people at large are the gainers, because whereas few people formerly—and those only the rich—could get water, now the supply is so widely extended as to be within the reach of all.

Again, the Commissioners cannot admit that there has been any deterioration in the arrangements for flushing and cleansing the sewers. In this respect also the very contrary is the case. The large increase in the supply of unfiltered as well as filtered water has afforded facilities for flushing which never before existed. The unfiltered supply has trebled within the last seven years. Every bathing platform also is a flushing tank in itself. There are now about 70 of such platforms at work. Although the drainage system has extended, the flushing of them has not failed to proceed hand in hand with the extension. The Commissioners hope that their remarks may not be misunderstood. They are most anxious to see the flushing arrangements in Calcutta further improved and extended; but the point which they desire to make is that this improvement and extension have not been neglected, and that the arrangements now in force, far from being worse, are really far better than they were in former years.

Lastly, it is alleged by Dr. Simpson that the conservancy arrangements of the town are more inefficient than formerly. This also the Commissioners must be allowed to say is a misconception. Much is still wanting to bring the conservancy arrangements to the higher standard which is desirable, but the Commissioners are in a far better position than Dr. Simpson can be to constitute a comparison between the present arrangements and those of former years. The amount of refuse and rubbish removed from the town is now about double what it was eight years ago. The waggon-load figures are reproduced in the margin. These represent the amount of refuse taken to the salt water lakes, and exclude the amount used for filling up tanks, but they are sufficient to indicate the large increase which has taken place in the work of this department. It may be true that as Dr. Simpson remarks "to one accustomed to the "cleanliness of a European town, the filth found in "all but the principal streets in Calcutta is simply "appalling," but it is not correct to add as he does that "since 1876 a constant "reduction of establishments on the ground of economy has placed the conservancy "in a much worse condition than previously." The expenditure incurred in cleansing and conservancy during the past seven years has been as follows:—

	No. of Waggon loads.
1878	7,284
1879	7,981
1880	9,155
1881	11,197
1882-83 (15 months)	16,948
1883-84	13,434
1884-85	11,511
1885-86	13,525
1886-87	14,107

Year.	Rs.
1880	1,45,302
1881	1,56,546
1882-83 (for 15 months the expenditure adjusted for 12 months will be Rs. 1,82,071)	2,30,933
1883-84	1,95,044
1884-85	2,16,994
1885-86	2,18,623
1886-87	2,22,478

In 1880, when the mortality from cholera was only 1·8 per 1,000, the expenditure on cleansing and conservancy was Rs. 77,000 less than in the past year, when the mortality was 4· per 1,000. Every year the expenditure shows an increase.

It is evident from these remarks that, as already implied, some wider causes must be looked for to explain the fact that, during the past 10 years, the deaths from cholera have been proportionately greater than they were during the previous quinquennial period. Although the mortality from cholera during the past year 1886 was 1,741, or no less than 4 per 1,000 of the population, it is equally true that, during the first nine months of that year, there were only 799 deaths, and that the mortality during those months was less than that during the same period of any of the previous 20 years, except the three well-known non-choleraic years 1871, 1872, and 1880. The deplorable outbreak during October, November, and December, occurred during precisely the same conditions of water-supply, drainage, and conservancy, as had prevailed during the comparative immunity of the previous nine months. Dr. Simpson himself admits, that the synchronous rise and fall of cholera in town and suburbs (and it may be added in the neighbouring districts), as regards time and season, is of almost invariable occurrence. The rhythm is regular. Calcutta is affected by causes not peculiar to Calcutta, but to all the neighbouring localities. The mortality is less in Calcutta in consequence of the extensive sanitary works which have been undertaken in this city, whereas, considering the density of the population and the tendency of all dense populations to become more unhealthy year by year, the reverse might have been expected to be the case. But an approximately corresponding ratio continues to exist between Calcutta and the adjoining populations. The opinion expressed by Dr. O'Brien, the late Health Officer of Calcutta, in his report in 1884, appears to the Commissioners to indicate more truly than the speculations of Dr. Simpson, the real conditions which are associated with the augmentation of cholera in the city. Dr. O'Brien wrote as follows:

Para. 43. "With this evidence of the gradual improvement that has been effected in the sanitary condition of the town before us, it would be manifestly incorrect to ascribe the augmentation of cholera to progressive insanitation. Intensity of cholera in a particular area may be said to depend on three main factors, viz., local insanitation, personal receptivity on the part of the population, and climatic causes. Local insanitation is certainly, as the experience of this city teaches, the chief and most potent agent in producing the disease, and that this condition still prevails to a wide extent in

the native part of the town is a fact but too well-known. But the state of things was equally bad, indeed, it may be affirmed, certainly worse in the years when the intensity of cholera was at a minimum. The second factor, viz., personal receptivity on the part of the population, remains the same as in former years. The population of the town now as then is largely recruited by immigrants from districts in which cholera is not endemic, and these form a class as the mortuary returns of the town show, highly susceptible to cholera. We are then driven to seek in the last factor, viz., general climatic causes, for the explanation of the increase in the prevalence of the disease in late years. The influence of this factor can be determined by contrasting the mortality from cholera in Calcutta for a series of years with that of the neighbouring towns and districts. Allowing as we may fairly do, that the sanitation of these places does not vary much from year to year, we nevertheless find that the amount of cholera varies greatly in different years. The accompanying diagram which I have extracted in part from the report of the Commission above referred to, illustrates the comparative intensity of cholera in the districts of Lower Bengal lying close to Calcutta, viz., Nudea, 24-Pergunnahs, Howrah, and Hooghly, including Serampore and in the town of Calcutta, Howrah and the suburbs, for a period of eight years. This diagram to my mind shows very clearly that, other things being equal, the intensity of the disease in the town from year to year, is regulated to a very large extent by general climatic causes, which affect equally the large tracts of country comprising the neighbouring districts. If one were to examine the town figures alone, he might be inclined to attribute the increase of cholera to some local cause, to think that perhaps it was connected with the filling of tanks, or that it was due to the extension of the system of underground sewers, or to the introduction of unfiltered water from the river into the bathing platforms, or to some other cause operating within the confines of the town. But a glance at the diagram would refute such theory, and show that the intensity of cholera from year to year is mainly regulated by causes which govern equally the distribution of the disease in districts in which no such conditions exist."

A similar opinion was expressed by Dr. Sanders in his report for 1885. The Commissioners are naturally most reluctant to oppose the opinion of their previous health officers to that now expressed by Dr. Simpson, but they consider it their duty to state their own views clearly on this important subject. The causation of cholera is a wide and difficult question, which has been most elaborately inquired into, but of which very little is known. It can only be said with certainty that the influence of sanitary work, the removal of filth, the admission of light and fresh air, the supply of pure water, the thorough flushing and purification of the drains, are the only methods for controlling the disease. With all Dr. Simpson's energetic personal efforts in these directions, and with his strong representation for the extension of the water-supply with which he concludes his memorandum, the Commissioners are entirely in accord.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1886-87.

(*Dr. W. J. Simpson.*)

The rainfall for the year (65·20) was 1·22 inches in excess of the mean of the preceding 24 years, but the variation throughout the year was rather unequally distributed. February, April, November, and December were altogether rainless months, while August and October were months of decidedly deficient rainfall; during the remaining months, July and September were prominent. September recorded a fall of 13·93 inches, which was no less than 3·75 inches in excess of the normal. May also was a month in which the fall was decidedly large, the excess fall being equal to 2·53 inches. This was due to the occurrence of an unusually large number of small local storms.

Vital statistics.

The birth registration appears to have been fairly satisfactory throughout the year, though the improved ratios of 1884 and 1885 had somewhat fallen off. The number of births amounted to 7,827 against 8,290 and 8,358 of the two preceding years. The birth-rate was equal to 18·0 per 1,000 against 17·2, the mean of the decade.

The peculiarly low birth-rate of Calcutta, compared with other towns, has been fully discussed by former Health Officers. It is mainly attributed to the exceptional preponderance of the male population over that of the female, the former numbering twice as many as the latter. This difference in proportion between the sexes exists only at certain ages, and not in the early and late periods of life. From infancy up to 10 years of age, and again after 60, the sexes are about equal in number; between 40 and 60, the males are almost twice as many as the females, while between 10 and 40, they become as disproportionate as 3 to 1. From this standpoint the birth-rate may be considered not an exceptional one.

Statement of Deaths from the most prevalent Diseases from 1876 *to* 1886.

Years.	Cholera.	Diarrhœa and Dysentery.	Fevers.	Small-pox.	Other Causes.	Total Deaths exclusive of Still-births.	Ratio per 1,000 of Population, Census of 1881.
1876	1,851	1,864	4,361	71	4,377	12,524	28·9
1877	1,418	1,683	5,151	67	4,906	13,225	30·5
1878	1,338	2,010	6,086	1,495	4,970	15,899	36·6
1879	1,186	1,516	4,796	772	4,345	12,615	29·1
1880	805	1,267	3,797	114	5,201	11,184	25·8
1881	1,693	1,491	3,765	133	5,446	12,528	28·9
1882	2,240	1,454	3,618	17	5,349	12,678	29·2
1883	2,037	1,307	3,442	73	4,925	11,784	27·2
1884	2,272	1,209	3,618	478	5,117	12,694	29·2
1885	1,603	1,655	3,831	155	5,463	12,707	29·3
Mean numbers	1,644	1,546	4,246	337	5,010	12,784	29·5
1886	1,741	1,258	3,422	15	5,011	11,447	26·4

The general mortality during the year was low; it was much under the mean of the decade, and occupied a second position only to 1880, a year of exceptional healthiness. The number of deaths amounted to 11,447, giving an annual death-rate of 26·4 against a rate of 25·8 in 1880, and against a decennial mean of 29·5. The

deaths recorded from small-pox, fevers, and bowel complaints were all below the mean of the decade. The deaths from small-pox were only 15.

On the fictitiously favourable light in which the mortality statistics place the public health of Calcutta I need not dwell. It has been commented on by former Health Officers, who have shown that much of it is due to the fact that the population of Calcutta is largely an immigrant one, and for the most part at an age when the chances of life are at their best. The Census figures show that more than half the population are in the full vigour of manhood and womanhood; and that the majority, when they become seriously ill, leave Calcutta for their homes.

Compared with the decennial mean, there has been a decline in the death-rate in all the wards. The quarters inhabited by the Europeans retain their usual low death-rate, and present a striking contrast to the other quarters of the town. Jorasanko and Colootolla, with a large and poor population living in crowded and filthy bustee lands, are distinguished by presenting the highest death-rate (31·4 and 32·9 per 1,000 respectively). It is not the wards that possess the largest area of bustee land which are the most unhealthy, but the wards in which the bustees are ill-arranged, overcrowded, and consequently in a filthy and insanitary condition.

The difference in rate of mortality between the races is great. The mixed races have the highest death-rate, *viz.*, 35·2, the Hindoos and Mahomedans come next on the list with death-rates of 28 and 24 per 1,000 respectively, and lastly, the Non-Asiatics with a death rate of 12·7. Little can be deduced from these figures. It would appear that the mixed races, who, as a class, are more permanent as regards residence in Calcutta than other races, have the highest death-rate. Their mortality might be considered as a more accurate estimate of the actual death-rate of the town, but the population numbers on which the statistics are based are not to be altogether relied on, owing, as stated in the Census report, to the likelihood of many including themselves amongst races to which they did not really belong.

Statement of Deaths according to Age for the Year 1886.

Ages.	Population.			Deaths.			Ratio of Deaths per 1,000 of Population per annum.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Born dead - -	—	—	—	284	233	517	—	—	—
0—1 - -	3,185	2,902	6,087*	1,346	1,114	2,460	422·6	383·8	404·1
1—4 - -	10,858	10,756	21,614	630	610	1,240	59·0	56·7	57·8
5—9 - -	14,472	12,963	27,435	229	227	456	15·8	17·5	16·6
10—19 - -	40,189	20,734	60,923	390	367	757	8·1	17·7	12·4
20—39 - -	152,293	56,774	209,067	1,848	988	2,836	12·1	17·4	13·5
40—59 - -	57,545	30,048	87,593	1,297	625	1,922	22·5	20·8	21·9
60—upwards -	10,275	10,225	20,500	828	948	1,776	80·5	92·7	86·6
Total and general ratios - -	288,817	144,402	433,219	6,568	4,879	11,447	22·7	33·7	26·4

—	Population.	Number of Deaths.	Ratio per 1,000 of Population per annum.	Ratio on estimated Births.
Hindoos - -	3,963	1,607	405·5	288·2
Mahomedans -	1,446	720	497·9	331·9
Christians - -	607	106	174·6	148·2
Other classes -	71	27	380·2	275·3
Total - -	6,087*	2,460	404·1	287·7

As usual, the infant mortality is conspicuous for its high rate. Other tables in the Appendix show that one-fourth the children who die under one year of age die within 15 days of their birth, and nearly 90 per cent. of these are registered as dying from tetanus. To be placed against this great infant mortality is the fact that at the Eden Hospital, where ordinary sanitary arrangements exist, the mortality from tetanus is nil.

Comparative Mortality in the Town of Calcutta and its Suburbs from 1877 *to* 1886.

Years.	Town.		Suburbs.	
	Actual Number of Deaths.	Ratio per 1,000 of Population.	Actual Number of Deaths.	Ratio per 1,000 of Population.
1877	13,704	31·6	14,025	55·7
1878	16,396	37·8	17,459	69·4
1879	13,044	30·1	13,835	55·0
1880	11,681	26·9	11,216	44·6
1881	13,030	30·3	11,143	44·3
1882	13,177	30·4	10,470	41·6
1883	12,325	28·4	10,429	41·4
1884	13,256	30·5	11,389	45·2
1885	12,707	29·3	11,267	44·8
Mean number	13,258	30·6	12,359	49·1
1886	11,447	26·4	10,187	40·5

In the above table, the mortality of the town is contrasted with that of the suburbs. In both town and suburbs the death-rate in 1886 is the lowest for the past 10 years; in the town it was 26·4; in the suburbs 40·5.

Fevers. The fever mortality in 1886 was the lowest that has been recorded. The number of deaths amounted to 3,422. Only one year in the decade approaches this mortality. In 1883 there were 3,442 registered deaths from fever. No class of diseases shows a more hopeful and continuous decline in their mortality. There have been in former years some remarkable fluctuations, but no previous record gives seven consecutive years with the fever mortality under 4,000 per annum.

Cholera. The cholera mortality in Calcutta exceeded by 97 the mean of the last 10 years. The number of registered deaths amounted to 1,741 against 1,644, the average number of the decade. The cholera mortality of 1886 ranks as high as fifth on the list of the 17 years which have elapsed since the introduction of the water-supply.

The first six months of 1886 were not marked by any great prevalence of cholera, and the number of deaths which occurred in March and April, were rather fewer than usual; but in October, November, and December an outburst severer than that recorded for the same months during the past 18 years occurred. In the margin are the number of deaths for the four quarters of 1886, also the number for the Suburbs for the same period, while annexed below is a statement showing the prevalence of cholera month by month during the year for the town and Suburbs.

1886.	Town.	Suburbs.
1st quarter	356	322
2nd „	213	268
3rd „	230	233
4th „	942	1,022
Total	1,741	1,845

Statement showing the prevalence of Cholera, month by month, for the Town and Suburbs in ratio per 1,000 *of totals during the Year* 1886.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Town	140	70	146	120	65	28	95	55	80	283	369	290	1,741
Suburbs	133	92	97	132	75	61	105	53	75	296	394	332	1,845

Statement showing the monthly prevalence of Cholera in Calcutta, Howrah, the Suburbs of Calcutta, and Neighbouring Districts of Bengal in 1886.

Districts and Towns.	Cholera Death-rate per 1000 per Annum.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
24-Pergunnahs -	5·52	3·84	2·28	3·24	1·20	·36	·72	·36	·60	2·52	5·88	16·32
Nuddea - -	1·80	2·04	3·60	11·28	6·84	·60	·07	·03	·03	·12	5·28	18·84
Jessore - -	10·20	6·60	6·96	14·40	4·68	·24	·01	—	—	·01	·36	—
Murshedabad -	·12	·12	·84	2·40	1·92	·36	·84	·36	·12	·36	3·36	5·52
Howrah - -	1·32	1·56	2·28	1·32	·36	·24	·36	·60	1·20	2·40	4·32	—
Hooghly - -	1·20	·72	·72	1·20	·08	·03	·12	·24	·12	1·80	4·20	9·5
Municipal Towns—												
Suburbs -	6·3	4·3	4·6	6·3	3·5	2·9	5·0	2·5	3·5	14·1	18·8	15·8
Calcutta -	3·8	1·9	4·0	3·3	1·7	·77	2·6	1·5	2·2	7·8	10·2	8·0

The figures are useful in showing the rise and fall of cholera according to season in those localities which are likely to be subjected to much the same meteorological conditions of rain and drought. They necessarily closely correspond in the rise and fall of cholera, if in each of them similar conditions for its prevalence are present.

The Hindoos and Mahomedans have most of the cholera divided between them. The Hindoos contribute 70 per cent. of the deaths, the Mahomedans 26 per cent., and the remaining races, Europeans, Jews, Eurasians, &c., about 4 per cent. The difference in population of the different races in Calcutta will hardly account for the liability of each; but the explanation is rather to be sought in the customs of the people, the manner of preparing their food, and the insanitary condition of their dwellings.

The cholera mortality was thickest along the riparian districts of the town, and also in the central portion of the town on each side of Machooa Bazar Street, a street continuous with the Hooghly Bridge. In fact, if this club-shaped portion of the town were excluded (*i.e.*, the northern riparian district being the handle, the southern riparian district and Machooa Bazar Street being the head of the club), although it is a small part of the town, yet the majority of the cholera deaths would also be excluded.

The deaths were densest in the most crowded and most filthy localities of the town, especially near Machooa Bazar Street and Cotton Street, where the streets are narrow, the houses are crowded together with but narrow and zig-zag passages between them, by which access is obtained to each; the huts and houses are planted pell-mell, with no relation to order or convenience of access, both the huts and houses teeming with human beings. Filth inside the houses and huts, seething filth outside, gully-pits leading to drains choked, sewer gas of the most offensive kind pervading the whole atmosphere, is the normal condition. Nothing short of a wide street, at least 90 feet wide, through this frightful locality, sweeping away the existing dens, and then rebuilding with some attention to order and regularity, will be of any effect.

The influence of sewer gas during the prevalence of cholera is worthy of attention. One example I may mention in particular, in which five children who slept in an upper-storied room were attacked in one night. There was nothing in the food or drink which could be discovered to have given rise to so sudden an attack, but a strong suspicion was formed that sewer gas was the cause. They had been exposed to emanations from the street sewer, owing to a pipe leading from the window of the bedroom communicating direct, without trap, with the sewer.

Cases of cholera frequently occur in Calcutta which are attributable to the condition of the suburbs. Many instances have come to notice in which Hindoos and Mahomedans visiting friends or attending festivals have been brought home affected with cholera. These imported cases often find in the home conditions for further development and extension.

Bowel-complaints.

Deaths from dysentery and diarrhœa numbered 1,258 in 1886, against a decennial mean of 1,546. The heaviest mortality was in January and December, the two coldest months in the year.

Small-pox.

The year 1886 has been a non-epidemic one for small-pox. There were only 15 deaths in the 12 months. The Health Department received intimation of 21 cases of the disease; of these, 9 occurred in Jorabagan ward, 3 in Shampooker, 3 in Fenwick Bazar, 2 in Colootolla, 1 in Burra Bazar, 1 in Collinga, and 1 in Hastings. Except in Jorabagan, where 3 cases occurred in one house, and others in close vicinity to it, the rest were isolated cases, and controlled by means of thorough and prompt vaccination.

All these cases occurred from January to October, but if the case imported by the steamship "Duke of Buckingham," which arrived in port on the 11th October, with small-pox cases on board from *Jeddah*, be excluded, the town may be said to have been free from the disease from September to December.

The cases were inquired into by the Department. Five occurred in children born in Calcutta, 4 were under, and 1 above one year; the 5 all unprotected. The rest were grown up people and temporary residents of the town. Six of these latter were inoculated and 2 vaccinated in their infancy, and the remainder were either unprotected or no history of previous protection could be ascertained.

On receipt of information, thorough search was made throughout the neighbourhood, and persons found unprotected were vaccinated, and as a precautionary measure, a large number, who had come in contact with the infected, were re-vaccinated.

Other causes.

The deaths from causes other than those included under the distinctive heads of cholera, bowel-complaints, fevers, and small-pox amounted to 5,011 against a decennial mean of 5,010. The causes under this heading are further elaborated and analysed in tables which have usually been appended to these reports, and which I, in turn, also append. They must, however, be appraised at what they are worth, which is, practically, not much, as they are not based on medical certificates.

Vaccination.

There were 11,338 vaccinations performed in the year 1886; of these, 9,971 were primary, and 1,367 were re-vaccinations. The corresponding figures of the previous year were 12,457 and 17 respectively. The decrease is due to paucity of unprotected children in the bustees. The systematic house-to-house inquiry for unprotected persons which was first commenced in the year 1884, and which led to the detection of very large number of unprotected people in that year and in 1885 was duly carried out in the year under report, but it had not led to the detection of such large numbers as were previously found. This was anticipated at the time. Dr. O'Brien, in his report for 1884, observed: "But it is obvious that this process cannot go on con-" tinually. The number of unprotected children must (under the present system of " house-to-house inquiry) decrease from year to year, and so, eventually, must the " number of vaccine operations."

In Calcutta both the humanized and animal virus were in use throughout the year, and four of the public vaccine stations, *viz.*, Medical College, 39, Beadon Street, Municipal Office, and Ripon Street Dispensary, were regularly kept supplied with a vaccinated calf all the year round. I made periodical inspection of the vaccinated children in these public vaccine stations, and found the lymph to be generally good.

The Vaccination Act was systematically and effectually carried out during the year.

There are certain points connected with the sanitary administration of the town to which I shall now refer.

Registration of deaths.

Death registration, as carried on in Calcutta, whether considered in regard to numbers, locality, or cause of death, is altogether unsatisfactory. As regards numbers, section 174 provides that a death shall be registered at the office of the registrar of the district or at the burning ghat or burial ground. To this end 18 district registrars, one for each ward of the city, and seven sub-registrars, were appointed. The sub-registrars were placed at four of the more important burning and burial grounds. By section 172 of the Act, the registrar is required to inform himself of every death happening within his district, and to ascertain and register the particulars of every such death. Evidently, therefore, it was the intention of the legislature to make the ward registration the basis for compiling the vital statistics. On the other hand, the sub-registrars' functions were to be subsidiary to those of the registrar, and were to be used as a help and check in the ward registration. In the working of the present system, however, the chief burden falls on the sub-registrars, while the

registrars' returns are rather made use of by way of supplementing the returns of the sub-registrars. When, for instance, a death takes place, the custom is to at once remove the body to the burning ghat or burial ground. The sub-registrar, if there is one, registers the name and address of the deceased, and the cause of death, from information given to him by the friends who bring the body. The burning or burial is then proceeded with. Sub-registrars are regularly stationed at all the burning ghats; but at some of the burial grounds the case is different. Should there be no sub-registrar, the burial takes place, and the relatives or friends of the deceased are expected to have the deaths registered at the registrar's office in the district in which the death took place. As, however, the district registrar has no means of discriminating between deaths which ought to be registered at his office and those which have been registered at the burning ghat or burial ground, any neglect to register in cases where bodies are buried in a ground unprovided with a sub-registrar, is not easily discovered. As a matter of fact, a good deal of confusion arises. We find about half the deaths registered both by the registrars and by the sub-registrars. Every month, however, a few deaths occur in the registrars' books which are not to be found in the sub-registrars'. These may be taken in most instances to represent burials in grounds other than those in which is a sub-registrar, but we have no means whatever of knowing what other persons have died in the ward and been disposed of in like manner.

The most efficient means of obtaining accurate numbers would be to render registration at the registrar's office compulsory with the granting of a pass certificate for burial or burning, without which no burial or burning should be allowed to take place. An objection is raised to this change, on the ground that it might involve delay in the customary quick disposal of the dead. This would be a very serious objection if the change led to such a result, but it is difficult to realise how with the registration offices always open, and scarcely more than one-fourth of a mile from any one part of the ward, the registering of the death and obtaining of a pass certificate would in any way retard the quick disposal of the dead.

A modification, however, of the present system would serve to give accuracy in numbers, viz., to render compulsory registration at the registrar's office *as well as* the sub-registrar's—that at the registrar's office taking place either before the burning or burial, or not more than one day after. This arrangement would place the registrar in his proper position, and give him the means of rendering the registration of deaths in his district complete, besides giving him the means of checking any failure of registration of death. If all deaths had to be registered, he would easily discover any omission. Of course, under the present system, if there was a sub-registrar at each burning ghat and burial ground, large or small, in and around Calcutta, the returns from the sub-registrars might form the basis for compiling the death statistics; but even then, these returns would not include those deaths occurring in each ward, the friends decide to take the body away to their own village. Only compulsory ward registration will meet this, and check failure of registration in cases where the body is taken to burial grounds other than that to which a sub-registrar is appointed.

Again, as to locality, registration not being compulsory in the district in which the death occurred, very unreliable particulars are entered in the sub-registrars' book. Touching one disease, viz., cholera, recently I have had an inquiry instituted into every death. In three months, of 675 cases registered as cholera, 171, or 20 per cent. had wrong addresses entered in the sub-registrars' book; 13 per cent. of these were traced, while 7 per cent. could not be traced. If inquiry were made into the other registered deaths, probably a similar result would be obtained.

There will always be great difficulty in obtaining anything like an accurate registration of the causes of death, due mainly to the fact that a large percentage of the population when ill never call for qualified medical aid. For that portion of the population we must in the mean time be content with the present very primitive system of ascertaining the cause of death. The registrar or sub-registrar asks the friends of the deceased regarding the nature of the disease, and the answer given by the friend or relative is duly registered as the cause of death.

There are two methods, however, by which the statistics may be made more useful than they are at present:—

(1.) By insisting on a medical certificate in the case of those who have had medical attendance. It is preferable to have a small percentage of the cause of deaths on which reliance can be placed than none at all.

(2.) An inquiry to be instituted into all cases of cholera, diarrhœa, dysentery, and typhoid fever, these being diseases essentially connected with insanitary conditions. During the later months of this year, deaths registered under these names have been investigated by medical inspectors, and some approach to accuracy obtained; but, as explained further on, these medical men have been discharged by the Commissioners, and now the statistics on these diseases are as unreliable and as useless for sanitary purposes as before.

In relation to buildings and laying out of streets, I have to suggest that the Commissioners should have full powers over the regulation of buildings, also the direction and the width of streets. I had hoped to have seen incorporated in the local Municipal Bill sections of a definite kind, which would have taken the place of a Building Act in Calcutta. There are certain regulating powers in the Municipal Bill, but of such a general character that they admit of nothing practical. They would never prevent a proprietor, if it suited him to do so, from filling up the compounds in the European quarter with other houses, however detrimental to health the want of space and the deprivation of free circulation of air round the building would be to the occupants of this and neighbouring houses. Examples of this kind could be pointed to which have occurred recently; nor will the regulations prevent the owner of a bustee which is covered with one-storied huts pulling down the huts and covering every portion of the land with brick-built houses which may be of two or more stories, and the only access to which would be by narrow and winding dark passages, obstructive of air and light, and fatal to efficient drainage. Such extreme examples are now to be found in different portions of the native town. The land so overcrowded with houses becomes an unhealthy area. Where there is space for five houses, double that number are erected. Daily we see houses being built in this fashion with little regard to access, aspect, ventilation, or drainage, and zig-zag passages gradually are formed which take the place of streets. When considerations of health or traffic raise the question whether the passage or lane should be widened, the acquired rights of property cause the owners to demand large compensation from the municipal funds. This expense, by a certain amount of forethought, can and ought to be avoided. For the public health of this town in future, more attention should be paid to the structural manner in which individual houses are placed in relation to others, and in which blocks of buildings and streets are laid out; otherwise the benefits to be derived from a sewerage and drainage system and other sanitary measures will be greatly diminished. Sewers and drains to work effectively cannot be laid down in a zig-zag fashion, nor with many narrow lanes and passages can scavenging be effectively performed. By these narrow and tortuous passages the cost of cleansing and scavenging is immensely increased, while the purifying influence of the wind is obstructed.

I look upon a controlling power over structural changes of buildings, both hut and brick-built, as one of the first of those sanitary principles which should guide the Commissioners in future, and not only should these principles apply to the older and crowded part of the town, but also to the suburban portion, which at an early date will be included in the city. Well arranged streets prevent those evils of overcrowding which are apt to arise in every city.

A model plan of the city, as it is intended to be laid out with reference to existing streets and future streets, both in town and suburbs, should be drawn and kept constantly in sight by the Commissioners, and no houses that interfere with this plan should be allowed to be built. The houses should adapt themselves to the streets and sewerage, and not, as has hitherto been the case, the streets and sewers being adapted to the faulty arrangements of the dwelling. Even for the older portion of the town such a plan is perfectly feasible. As explained in my third Quarterly Report, the tendency is to convert the one-storied bamboo huts into brick-built houses, a change, which unless conforming to what is necessary to public health and traffic, and strictly enforced, will eventually render the condition of these localities worse than they are at present, though it may be difficult to realize a worse condition. For that portion of the town already closely built over and in an unhealthy state, the improvement would be very gradual. A long interval must elapse before the plan would be realised, yet as every alteration would be with a view to its ultimate realization, there would be sure and constant manifestation of a real improvement in progress.

For the suburbs and extensions in that direction there is no reason why every piece of land should not be laid out according to a fixed plan, having for its object the avoidance of the frightful evils of overcrowding and of the ill-arranged houses and streets which prevail in the native quarters of the town, presenting at every turn an

obstacle to sanitary progress. Such a model plan in the Municipal Office would effectually put an end to houses springing up in all directions in utter disregard of the first principles of public health.

In a town such as this, in which large proprietors of land do not build rows of houses, nor construct or lay out streets at the same time for those houses, but every occupier builds his house or hut on a given piece of land, and that without reference to his neighbour's house or plot of land, there is only one way of attaining uniformity and preventing irremediable irregularity, *i.e.*, for the Municipality to pay strict attention to the building of *every house and hut* with special reference to access, frontage, ventilation and drainage, and to cause *each* to conform to the *plan* of streets and other details laid down in the Municipal Office. The plan, however, must be a definite one, and not subject to any one's caprice. The idea should be got rid of that because a man owns a few square feet of land in the city, therefore he has a right to build a house on it, irrespective of what may be the result to his own health or his neighbours.

In the plan I have mentioned would arise the question as to the width of streets, *i.e.*, the distance between the houses on opposite sides. Width of streets ought, for the narrow street at all events, to be fixed in relation to the proposed height of houses. The importance of this is apparent when we have such examples as Cotton Street, in some places 16 feet wide with houses 42 feet high, Old China Bazar 13½ feet wide and houses nearly 40 feet high, and Cross Street 15 feet wide with houses nearly 40 feet high.

Similar streets may arise in the bustees, in which there are roads, streets, and passages of width varying from 5 to 16 feet. Brick buildings erected on each side of these passages or streets would perpetuate and increase the insanitary influences that one would wish to avoid. Whenever a brick building is about to be erected in a bustee, it should be put back to a fixed line on either side of the narrow roads, so that, should all the huts be ultimately replaced by brick buildings, a moderately wide street would be ensured. The width of the street being determined by the height of the houses.

The same conditions of space should be a guide in the relation of houses to one another, so that each may enjoy a sufficiency of frontage, circulation of air and ventilation. Unless definite minimum standards are laid down for these, all control is lost; minimum standards do not mean that greater space may not be given. As much space above the minimum may be taken as the builder chooses, but *a minimum standard should be laid down, below which the Commissioners, as preservers of the public health, would not sanction.*

As with the streets and relation of buildings to one another, so with regard to the buildings themselves.

In regard to the disposal of the refuse and night-soil of the city, I have been in communication with Messrs. Alliot, Manlove, Fryer & Co., in England, as to the disposal of refuse by burning, and thus converting one portion into charcoal, the other into poudrette. I hope at a future time to be able to give a report on the subject. For the conservancy of the suburbs, where drainage, underground and surface, has yet to be begun and completed, the burning of the refuse and nightsoil would probably be the cheapest, most convenient, and best method of disposal; while for the town conservancy, if such a system be practicable, it would improve the drainage system immensely, the foul smells from which are at all times, except during the rainy season, most offensive.

Closely connected with the burning of the refuse is the question of its use for filling up tanks. Portion of the refuse gathered from the street, could, after passing through the furnace, be used for that purpose, and thus the practice which now prevails of filling up tanks with decomposable material, a practice which I view with many misgivings, would be put an end to. The tanks must be filled up; there is no uncertainty about that; they are the most fruitful sources of cholera and death to the inhabitants. No doubt the simple carting of street, stable, and other refuse into these tanks is a very ready and convenient mode of accomplishing this object, but the removal of contaminated water by placing in its stead a polluted soil is a questionable procedure. If the practice is to be stopped, the great difficulty that arises is where to get sufficient earth to fill the tanks without having to expend an enormous sum of money. The difficulty might be overcome in the following manner. For the last 16 or 17 years, the street refuse of the town has been carried to the Salt Water Lakes, and used for the purpose of reclamation. In the process of time much of the refuse has been converted into soil, which has lost all its decomposable material. Use might be made of this, and when the waggons loaded with town refuse are run out to the Salt Water Lakes, and have deposited their contents, they might, in place of returning empty, be taken round to those lands which could be marked out as having good and safe soil, and there be loaded with earth, which might be brought to a depôt near the town. From this depôt the earth would be conveyed in carts to the tanks to be filled.

Apart from the routine work of cleansing the streets, lanes, and public passages, another most important duty devolves on a sanitary authority, *viz.*, the provision of Inspectors of nuisances, to systematically visit the premises of the inhabitants, and to take measures for the removal of insanitary conditions wherever found; also for the prevention of nuisances which are of a recurring nature. It is impossible for the overseers of scavenging to perform these duties in addition to their own. Their functions are rather to look after the workers in the streets and bustees, and to supervise and see that these are properly cleansed. They have in consequence to be constantly on the move. Adding inspection work to their present duties would not improve matters, for either one or the other duty would be neglected, or, if not neglected, certainly not efficiently performed. Regular inspection of premises is the only method by which the extremely insanitary condition of most of the dwellings in the native quarter of the town can be removed, and such functions of inspection imperatively call for an establishment of the same order as that which obtains in other civilized communities. The streets may be well cleansed, but if conditions in and around dwellings are not dealt with, the primary evils injurious to health remain untouched. Choked drains, filthy compounds, every conceivable condition of unhealthiness which a day's inspection of any of the native quarters in Calcutta brings to light, all this is unaffected by the mere cleansing of the streets and bustees. The process is a whitewashing of the outside, while the inside, though in a worse and more dangerous condition, is left untouched.

Another sanitary duty requiring competent medical or sanitary inspectors is the inquiry into the causes of disease. No case of cholera, typhoid fever, or small-pox occurs in a house without an antecedent cause. For intelligent action in checking further progress of the disease, the case needs to be inquired into and measures taken accordingly. For example, in small-pox, besides the ordinary measures of disinfection, isolation, and vaccination, it is important to ascertain where the patient caught the disease, in order that the source may be traced out and dealt with; then, in cholera and typhoid fever, in addition to removal of conditions found on the premises, which are likely to be a nursing ground for growth and extension of these diseases, inquiry ought to be made as to how it came to pass that cholera broke out there, and if traceable to other cases.

It is only in this way by acting on positive information, and not at random, that check and control can be kept over zymotic disease. None of these sanitary duties can be performed without an agency. The Commissioners in November last, at a time of panic caused by the great prevalence of cholera, were under the circumstances influenced by my advice, and sanctioned, as the nucleus of a sanitary staff or department, 4 medical men as inspectors and 9 sub-inspectors for removal of nuisances, disinfection of premises, and inquiry into disease. These accomplished very good work, and something like an organised attempt was being made to remedy a few of the extremely insanitary conditions in the town; but now, after six months' work, the whole organisation has been broken up and dismissed on the ground of economy.

	Per month.
4 Medical Inspectors at Rs. 100 per month -	- 400
9 Sub-Inspectors at „ 50 „ -	- 450
	850

An inspecting establishment which costs less than 1,000*l.* a year, is considered too great an expense for a city with half a million of inhabitants, the terrible insanitary condition of which I have frequently brought before the Commissioners, and this, while every exacerbation of cholera, involves quarantine at European ports for vessels leaving Calcutta. Surely this is economy ill-directed.

Abstract of REPORT ON AN INQUIRY *into the* DISTRIBUTION OF CHOLERA IN CALCUTTA *during the past* 10 *Years, from* 1876–85.

As a supplement to this Report of 1886, I attach the results of an inquiry into the distribution of cholera during the previous 10 years.

I have been anxious to learn, as far as time would permit and materials at hand would allow, something concerning the local distribution of cholera in Calcutta during

the past few years. Information of this kind can be obtained only from the death statistics, the accuracy of which I have already in a former part of this report shown to be unsatisfactory. It may seem strange, then, to employ such doubtful material in this inquiry, but it is the only material at hand, and it is this which has formed the basis of all former annual reports, except for a short period during Dr. Payne's incumbency, when his large staff in the Nuisance Department, which was subsequently reduced, gave him the opportunity of testing the accuracy of the death reports.

Any speculation as to the causation of cholera on such statistics, or indeed on any statistics, must always hold a secondary place to what is ascertained concerning cholera by direct inquiry. It is, however, not proposed by these statistics to speculate at any length on the causes of cholera, but to obtain some definite information as to the degree to which different parts of Calcutta have within the last 10 years been liable to cholera. By the inclusion of a series of years, and the grouping of the cholera cases into districts, the errors of locality are probably much reduced.

With the foregoing object a search was made in the mortality books as far back as 1876, and every case of cholera extracted, with the street, number of the house, race, and date. These were arranged in tabular forms, which I have considered it unnecessary to reproduce here in the report, but which of themselves have afforded valuable information, showing how cholera has returned year after year to particular groups of houses, and how even some streets and localities, both in the north and south of the town, have throughout enjoyed immunity from cholera. The information retained in the Health Office will always be of great value.

The materials being at hand, two methods may be adopted in determining the local incidence of a special disease on a locality—(1) the proportion of deaths from the disease in question to 1,000 of the living population, and (2) the proportion of deaths from the special disease to 1,000 deaths from all causes which have happened in that locality.

To obtain the true relative proportion of deaths from each disease in each *locality*, probably the latter method is the more strictly accurate; for example, if we desired in different localities to ascertain what proportion of deaths were attributable to cholera, what proportion to fevers, what proportion to bowel-complaints and what to other diseases, and then to make these comparable with one another, that is, the cholera with fever and fevers with bowel-complaints, it is a moot point whether this method does not give more comparable facts than the other, when the statistics of the several diseases can be depended upon as being correct, and when each has been adjusted to the varying death-rates of the different places; but in dealing with one disease in order to ascertain its comparative incidence on certain localities, and on those localities during two different periods, the fewer variables introduced the less likelihood there is of error. For this reason I have taken the proportion of deaths to the population as a standard of comparison.

Every cholera case and the number of the house in which it happened, having been separately extracted from the death registers, it was easy to group the units into as large or small districts as convenient. The groups were arranged to correspond to the divisions or blocks into which the town was divided when the census of 1881 was taken. By this arrangement the number of cholera deaths could be compared to the population of each block, and the death-rate per annum for each calculated. The population of each block is small, and to compare the results of single years with one another would have been open to objection. To avoid this the 10 years have been divided into two periods of five years each.

(*a.*) For a period of 5 years 1876–1880.
(*b.*) For a 2nd period of 5 years 1880–1885.
(*c.*) For a period of 10 years 1876–1885.
(*d.*) For the single year 1886.

In examining the tables in the sectional list, the cholera figures of the 2nd period of five years will be seen to compare very unfavourably with the first period.

The cholera deaths in Calcutta are as follows :—

		Number of Deaths from Cholera.
The figures shows an increase on cholera in the 2nd period.	1st 5 years - - -	6,130*
	2nd 5 years - - - -	9,307

* The figures are exclusive of deaths in Port and Fort.

This is a very considerable increase, being over 50 per cent. Judging by the number of deaths registered from all causes, the last five years were not years of general unhealthiness; for during the two periods there were—

		Deaths from all Causes.
The figures show a decrease of deaths from all causes in the 2nd period.	1st 5 years	- 66,367*
	2nd 5 years -	- 63,140

The decline in the general death-rate in the 2nd five years is largely due to a decline in deaths from fevers. With a decreasing general death-rate, then, there has been no decrease in cholera, but, on the contrary, an increasing cholera death-rate. The difference becomes very marked when the cholera-rate of each period is compared with the general death-rate of its own.

Period.	Deaths from all Causes.	Deaths from Cholera.	Percentage of Cholera Deaths to Total Mortality.
1st 5 years - -	66,367	6,130	9·2
2nd 5 years - -	63,140	9,307	14·7

An inquiry like this cannot be disposed of in a short time nor hastily. Therefore, without prematurely attempting to enter into a full explanation of the causes giving rise to this increase of cholera, I shall simply describe what has been revealed by an inspection of the localities, and discuss briefly the intimate relation the present conditions bear to climatic influences, and what those climatic influences seem to teach. I have not inspected all the localities. The statistical compilation has been laborious, and has taken up a large amount of time, and, until completed, a systematic inspection could scarcely be begun. I have, however, inspected some of the worst and some of the best localities, and especially the riparian wards, and with special reference to their water-supply and drainage.

First of all, in regard to the public filtered supply. In Burra Bazar, Jorabagan, and Coomartolly wards, which have suffered very heavily from cholera, the distribution and quantity of the water-supply has, within the last five or six years, undergone a very great change. Houses which had formerly water-pipe connexions carried up to the second story, and from which a supply of water was obtained at certain fixed hours, are now without water on the ground floor.

Every house suffers more or less. Scarcity is not, however, confined to the riparian wards, though they probably suffer most severely. A general change over the greater part of the town has gradually taken place within the last few years, and even the southern districts suffer.

(1.) The return to a more frequent employment of water carriers.

(2.) The return to a greater use of the water in tanks and wells.

The Hindoos employ bharees, who bring the water in earthen vessels. The Mahomedans and others employ bhistees, who bring the supply in goat-skins. Even if these men are perfectly honest, and obtain the water from the standposts, there is no guarantee that the earthenware vessels or chatties or mussacks are clean, or have been kept in a cleanly place; then there is the storing of the water in the houses, by which it is liable to become contaminated. So that the dangers of drinking impure water, even when supplied from the hydrant, are very much increased.

The water carriers monopolise to a large extent the standposts in the street, and a difficulty is experienced by the poorer inhabitants in obtaining access to the stand-posts, consequently, it is not unfrequent for them to be unable to procure any hydrant water, and they have to be contented with the water from tanks and wells.

The analyses performed during this year of some of the tank waters, and the result of which is given in the Appendix of this report, will show that for the most part the water of the tanks is diluted sewage. In referring to the condition of the Calcutta tanks, I give the following extract from my 4th Quarterly Report:—

"It is almost superfluous to say that the water of the tanks in these bustees was very foul, always excepting those large tanks which are publicly conserved. The same remark might be made of nearly every tank in Calcutta, and especially of those in the native quarters of the town. Human ordure is seen on the edge of the water, and often

* The figures are exclusive of deaths in Port and Fort.

adjacent to utensils for cooking purposes and for storing water. The people in these instances simply bathe in, cook with, and drink their own filth, and they might as well, in many instances, drink and bathe in the waters issuing from a sewer. It is to water of this kind that some of the inhabitants are obliged to have recourse to owing to the great scarcity and very inefficient distribution of the filtered supply."

In this respect, then, the town has *approximated* somewhat to the condition of the suburbs, whose inhabitants depend on water obtained from tanks and wells. Owing, however, to the scattered condition of the suburban population, their wells have a greater chance of escaping pollution than those in the crowded and thickly populated town.

It may seem unaccountable that with only four to five million gallons daily in the early years of the introduction of the water-supply, and an increasing quantity given until the supply is now estimated at eight to nine millions, and during the present year 10 millions, that yet the water in many of the districts, and especially those near the river, is becoming less and less, and even attaining in some districts a positive scarcity. The explanation lies in the fact that the water has at present a larger area of supply, the connexions are much more numerous than formerly; the water is used for many purposes now for which it was not then supplied, while the waste is enormous, surpassing anything I have ever seen or known in other cities.

In 1870, 1871, and part of 1872, when a *continuous* supply was maintained night and day, 10 feet being kept up at night, 50 feet during the day; there were, in addition to the hydrant standposts in the streets, only some 4,000 house connections, now there are 16,000. In 1872, so great had the demand become for filtered water, that the night pressure had to be abandoned, and though an extra engine was added to the Wellington Street pumping station in 1872, and another to Tallah pumping station in 1874, while four new filters were added at Pultah in 1877, yet the demand has always been much in excess of the supply and of the distributing arrangements. The water is used, not only for many more purposes than in the early years, but it is misused and wasted to an enormous extent. This waste was foreseen by Mr. Clark, the late Engineer, as early as 1870, the year in which the water was first introduced, and in 1871 he prepared estimates for increasing the supply from six millions to 12 millions, a project which, however, has not yet been fully completed, but which Mr. Kimber, the present Engineer, is engaged in carrying out in a way that will allow of a much greater supply than at first proposed. Dr. Payne, in 1877, referred to the inadequacy of the supply at that time, and the need of obtaining a plentiful supply.

But neither of these gentlemen foresaw what has actually taken place and what the present Engineer has to contend with, viz., the construction of immense concrete tanks, or baths, in many of the native houses into which the filtered water is allowed to flow unchecked and run to waste. Some of the inhabitants thus obtain a more than plentiful supply at the expense of their neighbours. These tanks or baths are a natural consequence of the filling up of the numerous large tanks in the town, and as the inhabitants must have plenty of water, the customs of the country rendering this essential, it is not a practice greatly to be checked, but should be met by an increased supply, and proper water fittings and inspection. To place water-meters in these houses and charge according to the amount of water used would be no hardship on the occupants. It would be a means of preventing them from wasting the water of which their neighbours are deprived. Water-meters could only be placed in the larger houses. It would not be advisable to restrain the use of water except by inspection and proper fittings in the poorer and crowded localities. The filling up of tanks has lessened the quantity of water gathered during the rains, and has thus deprived the inhabitants of an immense amount of available water, for which no corresponding recompense has been made.

The filtered water-supply is not to be solely measured and considered by the quantity discharged at the pumping station, but it must also be considered in relation to its distribution throughout the town, and the quantity obtained at the peripheral ends. The amount that reaches the standposts in the streets and houses of the inhabitants must be taken as the test of supply, as well as the amount calculated from the working of the engine at the pumping station. If considered by the latter test only, a somewhat illusory idea is apt to be entertained as to the quantity of water obtained for use by each of the inhabitants. The examples already given show that though 7 to 8 millions of water are registered as being daily supplied to the town, still, as a matter of fact, the distribution and pressure is such in different quarters of the town that the majority of the inhabitants have been obtaining

within the last few years a very inefficient and poor supply of water. Wide distribution and waste are liable to be confounded with adequate and equal distribution.

There are peculiar difficulties in carrying out a drainage scheme in a town like Calcutta, and just allowances must accordingly be made for defects which would be considered glaring in other places. In English towns, often with more favourable levels, and always with more enlightened workmen, also with unremitting attention to flushing, ventilation and periodical inspection, the sewers and drains are often found defective, and notwithstanding the safeguards and precautions in force, *sometimes* give rise to disease. In Calcutta, then, where there is a difficulty in obtaining skilled workmen; where no adequate provision has been made for flushing the sewers and drains; where there is practically no systematic inspection of drains, and where gully-pits and pipes are frequently choked and injured by sweepers or others, stuffing all sorts of refuse into the drains, the existing state of the sewerage and drainage recently introduced into the northern and crowded quarters of the town, is no great matter of surprise. Its condition in many places may be said to be a chronic state of defectiveness.

The public sewers in the riparian wards were never found by me on examination to be choked, but very frequently most offensive emanations proceed from them, and become a source of nuisance and complaint, and add to the distress already produced from scarcity of water. This in the narrow and confined streets and passages must be a fruitful source of disease. The sewerage and drainage of Calcutta depends almost exclusively on the rains for flushing, a circumstance which permits them to become a source of nuisance during other parts of the year. The five principal sewers only are provided with flushing arrangements. As they, however, form a very insignificant part of the general *network* of sewerage and drainage of the town, and as long intervals sometimes elapse before the height of the tide in the river is sufficient to furnish a proper and adequate flush, practically the cleansing and flushing of the sewers has to be carried out under very formidable difficulties. Within the last few years flushing by means of carts has been largely made use of, but this expensive method can never compensate for proper arrangements. That the cart flushing is insufficient to keep the drainage in order, the stinks from every gully-pit and open grating or sewer ventilator is sufficient testimony. Sewerage without flushing arrangements is likely to discredit any sewerage system, however well constructed or well planned. Mere hand cleaning or rope cleaning, though necessary as an adjunct, is by itself of no avail. The inefficiency of hand cleansing for sewers may be instanced by the effect of a similar cleansing on a surface drain. Were a surface drain to have its filth removed by simply being swept with a broom and not by being at the same time thoroughly flushed down, the result would be unsatisfactory, and the smell proceeding from the drain perceptible. Such a drain would rightly be considered only half cleansed; so with an underground drain, water sent down with a flush, is necessary to keep it clean. Of the two, the half-cleansed surface-drain would likely be the least dangerous, for unless overshadowed by the eaves of huts or the walls and projections of buildings, it would probably have the advantage of the blazing sun playing upon it, and acting as a purifying agent, whereas the underground drainage would have sufficient moisture, temperature, and darkness to favour decomposition of the remaining filth and the rapid formation of noxious gases.

Certain provisions for the flushing of the sewerage and drainage were made by the projector of the scheme of drainage, but appear to have been abandoned, probably on the ground of economy. If ever there was a mistaken economy it is this. As oil is to machinery or fuel to an engine, so is flushing to a sewerage system. It is an essential part of the system. Without flushing, the sewers will not work properly; they will get out of order, become offensive, and end, as they are in this town in many parts, a dangerous nuisance, instead of being, as they ought to be, a most powerful factor in promoting the health of the town.

In England, where the temperature is low for a great part of the year, much attention has to be paid to flushing of sewers, otherwise the atmosphere would soon become tainted with sewer gas; much more is this flushing required in Calcutta, where the temperature at all times favours decomposition.

Notwithstanding this, however, the underground drainage, except when carried into narrow and tortuous streets and crowded localities, or into houses, has been a great boon to Calcutta.

Both water-supply and drainage are intimately linked with and inter-dependent on each other. Without the one the other is rendered less effective and less useful.

Without water the drainage is likely to become a dangerous nuisance. Without drainage water unremoved is likely also to become a nuisance. When again both are introduced, as they should be, constant inspection is necessary to ascertain whether they are working properly.

Having considered the water supply and drainage, I shall not enter into the defective conservancy and other insanitary conditions further than to note here that the present conservancy and nuisance arrangements allowed by the Commissioners are altogether inefficient for a city of this size, and totally inadequate to cope with the ordinary requirement of filth removal. To one accustomed to the cleanliness of a European town, the filth found in all but the principal streets in Calcutta, is simply appaling. Since 1876, a constant reduction of establishments on the ground of economy has placed the conservancy in a much worse condition than previously.

The three factors simultaneously at work during the past few years have been as follows:—

(1.) A scarcity of water, specially in the riparian wards. The scarcity, however, has in some degree become general throughout the town.

(2.) A system of underground drainage has been extended into narrow streets without sufficient provision for its flushing and cleansing.

(3.) Inefficient conservancy and nuisance removal.

Following closely on the tract of these changes, and in the localities where these insanitary conditions are most intense, a recrudescence of cholera has taken place. There may be other influences at work to which I shall at a future time refer, but certainly the three mentioned above are the most striking and most frequent conditions discoverable in the worst cholera localities.

Inspection of the localities which have few cases of cholera presents a very different array of facts. In these localities the inhabitants have in their houses plenty of water, the drainage is not carried inside the houses, and fair conservancy is the rule, while a good circulation of air is allowed in and around the houses. Here, cholera, even at its worst time of prevalence in other parts of the town, is absent, and, if it does find entrance, it is usually amongst the native servants who have been in other parts of the town, and who have caught the disease; occasionally, however, some individual in these localities is attacked with cholera, but, generally, so isolated is the case that the cause may be readily attributed to something extrinsic from the locality.

In considering climatic conditions in relation to cholera prevalence in Calcutta during the past 10 years, it will be necessary to take a somewhat larger survey of the prevalence of cholera in previous years.

The following tabular statement shows the incidence of cholera year by year since 1866, also in quinquennial periods:—

Years.	Cholera.*		Total Deaths from all Causes.*		Percentage of Cholera to Total Deaths.
	Deaths.	Ratio.	Deaths.	Ratio.	
1866	6,826	15·7	20,283	46·8	33·6
1867	2,270	5·2	12,437	28·7	18·2
1868	4,186	9·6	13,733	31·6	30·4
1869	3,582	8·2	12,743	29·4	28·1
1870	1,558	3·5	10,401	24·0	14·9
	18,422	3·5	69,597	32·1	26·4
1871	796	1·8	10,289	23·7	7·7
1872	1,102	2·5	10,352	23·8	10·6
1873	1,105	2·5	10,356	23·9	10·6
1874	1,245	2·8	11,527	26·6	10·8
1875	1,674	3·8	14,086	32·5	11·8
	5,922	2·7	56,610	26·1	10·4

*These figures include deaths in Fort and Port.

Years.	Cholera.*		Total Deaths from all Causes.*		Percentage of Cholera to Total Deaths.
	Deaths.	Ratio.	Deaths.	Ratio.	
1876	1,851	4·2	12,964	29·9	14·2
1877	1,418	3·2	13,704	31·6	10·3
1878	1,338	3·0	16,396	37·8	8·1
1879	1,186	2·7	13,044	30·1	9·0
1880	805	1·8	11,681	26·9	6·8
	6,598	3·0	67,789	31·2	9·7
1881	1,693	3·9	13,030	30·0	12·9
1882	2,240	5·1	13,177	30·4	17·0
1883	2,037	4·7	12,325	28·4	16·5
1884	2,272	5·2	13,256	30·5	17·1
1885	1,603	3·7	12,707	29·3	12·6
	9,845	4·5	64,495	29·7	15·2

* These figures include deaths in Fort and Port.

Except during the quinquennium 1871 to 1875, the general death-rate from all causes has not been very materially affected, if the numbers are to be trusted. The general death-rate from 1866 to 1870 was 32·1; from 1871 to 1875 it was 26·1; from 1876 to 1880 it was 31·2, and from 1881 to 1885 it was 29·7. By far the lowest death-rate was in the quinquennium 1871 to 1875, or if the several years are taken, during the years 1870, 1871, 1873, and 1874.

In the table are three distinct cholera periods—

1st. From 1866 to 1870 there were 18,422 cholera deaths in five years, giving a deaths-rate of 8·5 per 1,000 population.

2nd. From 1871 to 1880 there were 12,520 cholera deaths in 10 years, giving a death-rate for the 1st five years of 2·7, and for the 2nd five years of 3·0, or for the 10 years of 2·8.

3rd. From 1881 to 1885 there were 9,845 cholera deaths in five years, giving a death-rate of 4·5 for the five years.

It is evident from the cholera figures that some great restraining influence as regards prevalence of cholera was at work in the 10 years between 1871 and 1880, which appears to have been absent in previous years, and which for the last six years has lost half its power; also that the cholera mortality and the general mortality do not always go hand in hand.

The next table includes localities which are likely to come under the same climatic conditions, such are the Suburbs and Howrah. Howrah and the Suburbs are localities immediately surrounding Calcutta, but, unfortunately, their statistics of cholera mortality do not extend further back than 1872. There is this also to be remarked that registration of deaths having been introduced for the first time into the Suburbs and Howrah in 1872 and 1873, the low numbers registered for the first year in both these localities may be due to defective registration.

Years.	Town of Howrah.		Suburbs.		Calcutta.		
	Number of Deaths.	Death-rate.	Number of Deaths.	Death-rate.		Number of Deaths.	Death-rate.
1871	—	—	—	—	1st period.	796	1·8
1872	—	—	1,084	4·3		1,102	2·5
1873	458	5·0	1,768	7·0		1,105	2·5
1874	high 759	8·3	2,038	8·1		1,245	2·8
1875	578	6·3	2,316	9·2		1,674	3·8
1876	512	5·6	2,316	9·2		1,851	4·2
1877	437	4·3	1,908	7·5		1,418	3·2
1878	615	6·7	2,363	9·3		1,338	3·0
1879	397	4·3	1,870	7·4		1,186	2·7
1880	218	2·3	980	3·5		805	1·8
1881	489	5·3	1,879	7·4	2nd period.	1,693	3·9
1882	668	7·3	2,349	9·3		2,240	5·1
1883	556	6·1	2,132	8·4		2,037	4·7
1884	high 707	7·7	2,421	9·6		2,272	5·2
1885	372	4·0	1,877	7·4		1,603	3·7
1886	528	5·8	1,844	7·3		1,741	4·0

In the cholera mortality of Calcutta there is a first period in which a gradual rise took place from the year 1871 to 1876, and a gradual fall from 1876 to 1880. Then comes a second period, and, as if cholera was beginning a new era in Calcutta, the year 1881 starts with a higher figure than any in the preceding decade excepting that of 1876, and attains at its highest nearly double the mortality of ordinary years in the previous decade. The figures are highest in 1884; and in that year exceed in mortality by 2, one of the best years in the period before 1870. or in the pre-sanitation period, as it has been called.

Between 1870 and 1880 the Howrah and Suburban mortality followed a somewhat similar course; with one exception, however, *viz.*, the mortality of 1878, which was high in both these localities, and not in Calcutta. During this first period there is a general sort of agreement between the cholera mortality of the Suburbs and the town of Howrah; more so, indeed, than between these two localities and Calcutta; but, notwithstanding this general correspondence, the year in which the highest mortality of the town of Howrah occurs does not correspond with the year of the highest mortality in the Suburbs.

From 1880 to 1886 there is, however, a fairly close correspondence between the cholera mortality of all three localities. 1882, 1883, and 1884 were bad cholera years in all, just as 1880 was a non-choleraic year in all, or perhaps, more precisely, a year in which few cases of cholera occurred, or only about one-third the number of deaths from cholera being registered, compared with the number registered in what are called bad choleraic years. As in Calcutta during the second period, a regular rise and fall of the cholera mortality takes place, so in the town of Howrah and the Suburbs a similar rise and fall takes place. With seasonal conditions similar to Calcutta, the Suburbs and town of Howrah did not suffer during the last quinquennium with proportionately the same cholera intensity as Calcutta had done. They always registered a higher cholera-rate than Calcutta. But the rise both in Suburbs and Howrah during the last quinquennium is not greater than the height reached in them in some of the years of the previous decade, while the rise in Calcutta attained a much greater height than it ever approached in the preceding 10 years. This greater proportionate intensity of the cholera mortality in Calcutta is further shown in the following table, in which are included the four years distinguished for their highest cholera mortality in Calcutta, both in the first and second period, and the proportion these statistics bear to those of Howrah and the Suburbs:—

Years.	Town.	Suburbs.	Howrah.	Proportion.		Proportion.	
				Town.	Suburbs.	Town.	Howrah.
1st Period.							
1874	1,245	2,038	759	100	163·6	100	60·9
1875	1,674	2,316	571	100	138·3	100	34·5
1876	1,851	2,316	512	100	125·1	100	27·6
1878	1,338	2,363	615	100	176·6	100	45·9
2nd Period.							
1881	1,693	1,879	489	100	110·9	100	28·8
1882	2,240	2,349	668	100	104·8	100	29·8
1883	2,037	2,132	556	100	104·6	100	27·2
1884	2,272	2,421	707	100	106·5	100	31·1

It will be seen that in the first period for every 100 deaths occurring in Calcutta, 163, 138, 125, and even 176 occurred in the Suburbs, and about a third that number in Howrah. In the second period, however, for every 100 deaths in Calcutta not more than 110, and even as few as 104 took place in the Suburbs, and still fewer in Howrah.

That is, the Suburbs and Howrah have been improving in their cholera death-rate, or Calcutta has been getting worse; one or the other event must have happened to bring them into such close approximation.

There is, however, no such improvement in either the Suburbs or Howrah; in them the death-rate, as shown in the previous table, is very much the same at both periods. Whatever climatic influences favouring cholera prevalence were at work in the two different periods, certainly, they did not produce in Howrah or the Suburbs a greater

effect in intensity in one period more than in the other; on the contrary, they seem to have had about the same effect on both periods. A remarkable feature to be noted, is that while the starting point of the rise in the second period as regards the mortality of Howrah and Suburbs in 1881 is lower than at least four different years of the first period, the starting point in Calcutta in 1881 is higher than all but one of the years in the first period, and continues throughout very high, over-topping by a very long way the mortality of previous years. This over-topping only occurs in one year in the Suburbs, and not at all in Howrah. Another remarkable fact should be noted here, and to which I shall afterwards refer, *viz.*, that the year 1880 was in the three localities essentially a non-choleraic year; 1871 was also a non-choleraic year for Calcutta, and probably if the figures were to be had for that year, the same would be found to be the case also for Howrah and the Suburbs.

If anything can be inferred from these figures, it is that, assuming as has always been done that seasonal conditions favourable to cholera have prevailed during the second period, they have acted and continue to act with proportionately greater intensity on the town than on the Suburbs or on Howrah, a conduct quite the reverse of the previous 11 years. The explanation which certainly forces itself on one, is that the favouring climatic agencies, whatever they may be, found in Calcutta during the last six years some weak point or points which rendered the town more vulnerable to cholera prevalence than it had been since 1870, and which caused it, when compared with previous years, to approximate relatively to the cholera death-rate of Howrah and the Suburbs. It has already been shown that in Calcutta itself the seasonal conditions have acted and continue to act with greater proportionate intensity in some of its districts than in others, and especially in those districts in which the water-supply and means of cleanliness are most deficient.

Generally stated, the most favourable seasonal conditions which favour cholera prevalence are drought and high temperature. Drs. Cunningham and Lewis, in their researches into the physical conditions which promote cholera prevalence, came to the conclusion that no one meteorological condition was the determining factor, but the most constant appeared to be that combination which affected indirectly the ground water level and soil ventilation. The greatest factor influencing these two conditions, is the quantity and frequency of the rains, though that influence may be and is much neutralised by other variable climatic factors. That cholera prevalence is influenced in the endemic area by the quantity and frequency of the rains, is apparent enough in the yearly diminution of cholera in the rainy season; in the temporary check given to cholera prevalence by a few prolonged and heavy showers of rain; and by the fact that the years distinguished for the quantity of rain, the frequency with which it has fallen, and a general low temperature, with high humidity, preventing great evaporation, have been years in which cholera is conspicuous for its low mortality. For example, the years 1871 and 1880 seem to have possessed these conditions. They are years both in Calcutta, and Suburbs with remarkably few deaths from cholera; 1871 was distinguished for much rain and low temperature; 1880 had a low spring mortality from cholera, and Dr. McLeod, in remarking on this, observed that, possibly, it was due to the abundance of rain in February of that year.

None can doubt the fact that a great change has taken place in the history of cholera since 1870 in Calcutta. Dr. Payne most clearly brought this out, and attributed the change to the water-supply. Dr. Baker, Secretary to the Michigan State Board of Health, America, and others have shown that the relation which the rains bear to cholera prevalence also point to the same conclusion. The synchronous rise and fall of cholera in town and suburbs as regards time and season remain as before. The rythm is as regular as formerly; the rise taking place at the beginning of the hot season and the fall in the rainy season; then again a rise and fall in October and November.

In Calcutta, however, the synchronous rise and fall has been most remarkably affected in *its extent*, or perhaps more accurately the rise has been materially affected in *its height*. This will be observed in the diagram (facing page 11) in which is shown the rise and fall of cholera in the different years and the extraordinary change which took place coincidently with the introduction of the water-supply. Other changes, however, besides a new water-supply, took place in 1870, which doubtless had their influence.

The town of Calcutta, in obtaining its water-supply from the river, at a source far up and distant from the city, thereby insuring purity, became to *that* extent, for a portion of its drinking water, independent of the rains. Henceforward, the town was

supplied, through water pipes, with a daily quantity of river water, which placed it on a totally different footing with the neighbouring districts and with itself of former years. In becoming partially independent of the rains, it became also partially independent of the seasonal conditions which seem to affect the prevalence of cholera. Contemporaneously with this change, the river water flowing past the city, in which the Hindu inhabitants bathed and from which they drew large supplies of water, no longer suffered contamination to its former enormous extent from putrifying carcasses and night-soil; further, the improvement of the disposal of refuse, while it lessened the pollution of the atmosphere, also lessened the liability to contamination of the then existing water-supplies—the wells and tanks in the homes of the people. Thus, in three different ways, the inhabitants were in a much better position in regard to the purity of the water they used for domestic purposes than they had ever previously been. But though the introduction of the water-supply caused a portion of the inhabitants to be no longer dependent on a water-supply from a polluted river or from polluted tanks and wells (or from tanks and wells liable to pollution), the remaining portion of the inhabitants who were not supplied with pure hydrant water, were in the same position as the inhabitants of the suburbs, and relied still on their wells and tanks, and were therefore as much subjected to seasonal influences as the suburban population. That a synchronous rise and fall in cholera mortality continues to present itself both in town and suburbs, is no greater matter of surprise than that *wherever* the seed of a plant has been sown in a favourable soil, budding takes place in spring and flowering in summer; without the seed, however, there is no growth, without the favourable soil into which the seed has been sown, there is no manifestation; let the seasons be what they may. But with the two first conditions present, then the seasons no doubt play an important part in the causation. There are seasonal prevalences of small-pox, of scarlet fever, of typhus fever, and other diseases, but we do not attach much importance to the seasons as the immediate cause of an outbreak or prevalence of these diseases. The fact of the synchronous rythm of cholera affecting Calcutta, as well as the suburbs, only shows that the media or conditions whereby cholera flourishes and propagates itself at certain seasons are yet present in the town as in the suburbs, though a deep impression has been made on the town conditions. In a good year the town and suburbs will present few deaths; the town fewer than the suburbs. In a bad year both town and suburbs will suffer from cholera; the town to a less extent. Periodicity in cholera is no more remarkable than periodicity in other diseases. Probably the laws which govern periodicity are beyond control, but the media by which the agents causing disease gain access to our bodies, are, so far as is known, fully under control.

Placing aside the part played on the purity of the air by the improved disposal of the refuse, a very important fact to be borne in mind, in dealing with the seasonal prevalence of a disease, is that the introduction of the water-supply and the other means provided for safe-guarding the supply, were sufficient to have a powerful restraining effect on seasonal influences, and, that, before the drainage was generally introduced. In fact, one important seasonal condition has been partially brought under control. The effect of the rains generally stated both in town and suburbs is a cleansing effect. They purify the air, they wash the filth from the soil, they purify and give an abundant supply of water to the wells and tanks, but, in addition to these things, in the town they perform a most important function, they flush the drains. Now the water-supply from the river can do all these except purify the air, and indirectly it can accomplish that by affording a means by which filthy localities can be cleansed. As a sanitary agent, except for purifying the air, it matters little, whether water, if pure, is taken from a river, or that we allow the water to flow past the city to the sea, and receive it back in the form of rain. The only difference is that in the latter case we depend on climatic agencies and on a primitive and often dangerous mode of collection, *viz.*, by wells and tanks liable to contamination from direct pollution or from a polluted soil, while in a former case, we have the whole under our own control, and climatic agencies are reduced to a minimum. The efficient removal of the refuse prevents the air, the soil, and the water from becoming contaminated.

As the sum and substance of this part of my report, I would urge that more water, filtered and unfiltered, be obtained from the river. It is simply a delusion to suppose that the prospective increase will be sufficient for the town and at the same time sufficient to give even four million gallons daily to the suburbs or to any part of the suburbs. We have 10 millions coming in daily at the present time, and yet there is scarcity in those parts supplied; while many of the inhabitants in some localities in

the town have still to go long distances for their water-supply. The town proper will require the whole of the prospective supply, and to lessen it by supplying the suburbs will not be to remedy the evil from which the inhabitants of the town are at present suffering, but to continue the evil. The suburbs require a supply for themselves. The standard quantity of water-supply for English and European towns, in which water is used carefully and sparingly, and in which the majority of inhabitants are not accustomed to bathe summer and winter, several times a day, or even once a day, cannot be taken as the measure of a town like Calcutta in which the inhabitants daily use a very large quantity of water. The customs of the inhabitants and the temperature of the climate absolutely necessitate a more plentiful supply of water than is deemed essential for the health of a community with totally different customs and living in a temperate climate.

In concluding, it is only fair to remark that though the relative position of the cholera death-rate of Calcutta with its Suburbs has been disturbed of late years, yet the cholera-rate at Calcutta is still far below the Suburbs. Considering the density of the population of Calcutta compared with the Suburbs, and the tendency of all dense populations to become more unhealthy year by year unless most strenuous efforts are made in sanitation, the fact that the cholera-rate is still far below the Suburbs is striking testimony to the influence of sanitary work in Calcutta controlling the disease; at the same time the return to a higher rate in Calcutta compared with previous years, means that the sanitary work has not kept apace with the requirements of the town.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1886-87.

(Lieut. Colonel G. M. J. Moore, President.)

Black Town Drainage.—The total expenditure during the year amounted to Rs. 1,71,759-9-0. Much more work might have been done, but under the orders of the Commissioners no new work was undertaken after August 1886 as they desired to have before them a report on the work as executed. This report, made by Colonel Pennycuick, dated the 28th January 1887, is embodied in Government Order No. 120-M., dated 10th February 1887, and is extremely satisfactory. The works were again being pushed on at an ordinary speed only at the end of the year. The revised estimate for the works as laid before the Commissioners amounted to Rs. 9,41,000 as against Rs. 8,07,500 the amount of the original estimate, but Colonel Pennycuick advised that Rs. 59,000 should be added for contingencies, making the total amount of the estimate as Rs. 10,00,000. It is not anticipated, however, that this amount will be reached. Drainage.

Sewer No. I.—The masonry portion of Sewer No. I. was completed before the commencement of the official year under review. The stoneware pipe portion was not commenced until May 1886. The interval was occupied in examining the portion of the sewer completed. The result of the examination was very satisfactory. Only one portion was found to leak slightly. Without much trouble this was effectively stopped. There was however a minute stream of water passing through the sewer. This is not more than the expected flow produced by an imperceptible percolation through the masonry, which it is impossible to prevent in masonry sewers below the permanent level of saturation. This point has already been noticed in the Administration Report for 1884–85. The recent report of Colonel Pennycuick on the Drainage Works disposes of this question in a conclusively satisfactory manner. Considering the high level of the subsoil water in Madras and the extremely bad soil on which portions of the sewer were constructed, the amount of flow in Sewer No. I. is remarkably small. The section of the sewer commenced in May 1886 consists of 18 inch stoneware pipes. Owing to the proximity of buildings on both sides of Popham's Broadway and the anxiety to keep the traffic of this important section of the street open as far as possible, the progress made was moderate though steady. Before the end of September pipes had been laid between Thathamoothiappen Street and Market Street, a length of 1,330 feet, making the total length of sewer completed 6,644 feet. There now remains only a length of 945 feet to bring the sewer to its completion.

Sewer No. II.—In the beginning of April the examination of the 24-inch brickwork sewer was undertaken, commencing from junction well of Sewer Nos. 1 and 2 at the North end of Popham's Broadway. This undertaking necessitated the working of the 8-horse-power engine and centrifugal pump at the junction well, to remove the accumulated water in the well and sewer from rain and subsoil; after this was done the sewer was left in a comparatively dry state to admit of the workpeople to proceed with the examination of the interior of it. A few small leaks were stopped between the junction well and man-hole No. 7 near the Royapuram lines. Near the Medical Auxiliary School a leak was found in the invert of the sewer that could not conveniently be dealt with owing to its great distance from either of the adjacent man-holes, which are 264 feet apart; as this inconvenience would also apparently be felt for the purpose of cleaning when sewage is allowed to flow into the sewers, it was deemed necessary to construct an intermediate man-hole about midway between the adjacent man-holes. On doing this we were enabled satisfactorily to stop the larger leak and several smaller leaks that occured in this length. The sewer at this point is about 18 feet below ground level and 8 feet below subsoil water-level; here a well was sunk and the 6-inch pulsometer was employed to pump out the water; when this was being done the pumping at the junction well was stopped. Opportunity was taken to lay fresh cement concrete for a depth of about 4 feet in each of man-holes Nos. 7, 9, and the extra man-hole constructed (used as wells during the construction of the sewer) in which were

found some leaks. The pumping was then stopped to allow of the concrete laid in the wells to set.

The examination of the sewer recommenced about the latter end of August, after allowing time for the setting of concrete laid in these man-holes referred to above. Between man-holes Nos. 8 and 10, not far from the Seven Wells, it was found that the percolation in the sewer was more than in the remaining length of the whole work. After the excavation and timbering were completed for lengths of 82 and 105 feet respectively, between man-holes Nos. 8, 9 and Nos. 9, 10, it was found that the subsoil water stood 3 feet over the top of the sewer. The lengths of sewers above noted were carefully examined: the first length was quite perfect; there was no visible crack in the plastering in the second length, the plastering was damaged in small patches and detached from the brickwork; this may have been owing to the filling-in being done when the work was not quite set. The whole length of the exterior of the sewer received an extra coat of cement plastering. The sides of the sewer above the level of the invert for the lengths opened up were rendered with extra cement concrete 6 inches deep. Finally the top of the sewer was covered with puddle 6 inches deep and extra clay laid over it for an additional depth of 6 or 9 inches. The leaks were found to be considerably reduced by this treatment, but the infiltration of subsoil water was not entirely prevented.

Sewer No. II.—18-*inch Pipe Section.*—About the beginning of May the 18-inch pipe section was started from the termination of the 24-inch brickwork sewer on the south side of Peddu Naick Street, and was joined in November to the portion of sewer laid about a year ago to the south of Theeroopully Street. The sewer is thus completely laid for its whole length, with the exception of a few short breaks where the overflows have yet to be constructed. Considerable difficulties were experienced in consequence of heavy rains, several times the trench was flooded and a large quantity of earth and slush washed into the pipes, and the removal of these extraneous matters was with much difficulty accomplished.

Sewer No. II.—12-*inch Pipe Section.*—This section was commenced from nearly opposite Stringer's Street and is laid on the west side of Wall Tax Road to within a distance of 50 feet of the junction point of the street with the General Hospital Bridge Road. The average depth of the excavation was 5 feet.

The total length of Sewer No. II. completed during the year is 2,668 feet, making a gross total of 12,761 feet.

Surface Drainage.—Notwithstanding that operations were suspended pending the receipt of Colonel Pennycuick's report on the Madras drainage, good progress was made with the works in hand; 51,642 feet of all sizes of drains were constructed during the year, as compared with 43,588 feet during the previous years which, shows an increase of 8,054 feet. This increase is due to the steady supply of table moulded bricks from the Government Brick Factory. During previous years these bricks were obtained from contractors and the supply was precarious and the work was often delayed.

House Drainage.—The amount spent by the Municipality on house drainage during the year was Rs. 2,961-4-6; of this Rs. 2,516-10-10 was received from the owners leaving Rs. 444-9-8 yet to be recovered. The house drains repaired and altered by the Municipality were 266, and by the owners 1,266 during the year. This would make a total of 4,970 up to 31st March of which 1,164 were repaired by the Municipality.

Street improvements in connection with Drainage.—These are not included in the drainage estimate but are being carried simultaneously with the drainage. In March last plans were prepared for the improvement of Annah Pillay Street, an improvement commenced and partially carried out so long ago as the year 1869. Endeavours were made to purchase the property required by private agreement, but this failed. Government then sanctioned the acquisition of the property under the Land Acquisition Act. At the end of the year no property had been handed over but the valuation was found so excessive that a slight modification of the plan of the improvement will be desirable. Another improvement sanctioned was the widening of a lane called Parea Woothundy Alley at the south-west entrance to the Cutwal Bazaar. The property for this is also being acquired under the powers given by the Act previously mentioned. No property had however been handed over within the period with which this report is concerned.

Other New Drainage.—Drains in length 1,975 feet were laid in Astaboojam Road at a cost of Rs. 1,420-11-8; also in General Patter's Road, in length 1,138 feet, at a cost of Rupees 2,357-12-9; a drain was also cut from Andeappah Moodelly Street (1st Division)

along the boundary of the Robinson Park to discharge flood water from Tinnevelly Settlement and Singara Thottam into the main drain. This drain costs Rs. 151-2-0.

Triplicane Drains.—At the end of March 1886 Government decided to proceed with the removal of the fishing village on the Beach just to the south of the Presidency College, and the new site selected for the village was a portion of the Triplicane Farm on the west bank of the canal. Government decided also to take up the portion of the farm on the east bank, and in order to effect these improvements it was necessary to find some other outlets for the sewage coming from the portion of Triplicane lying north and south of Pycroft's Road.

This was done by providing arrangements (at present six picottahs), to lift the sewage at the Triplicane outlet to convey it to Kistnampett Farm. To effect this a 12-inch pipe 2,750 feet in length was laid along the west bank of the canal which discharges into the head of the syphon leading into Kistnampett Farm. At the farm itself a large tank was constructed 235 feet by 110 feet, which will contain, at a depth of 7 feet, 1,26,000 cubic feet or 7,87,500 gallons of sewage, thus allowing of the sewage being baled during the day and the tank being filled at night from the picottahs at Triplicane, when sewage cannot without nuisance be distributed for irrigational purposes. At the same time the farm at Kistnampett was extended along the east bank of the canal for a distance of 667 feet and 252 feet in breadth, on land handed over to the Commissioners in the year 1877, but which up to this time had been unutilized.

In addition to the above works provision was also made for the alteration and diversion of the drain that brings down the sewage to the first set of picottahs from Pycroft's Road. The drain that previously existed consisted of 447 feet of open masonry drain and 700 feet of ditch drain. The object of the alteration and diversion was to find greater accommodation for the fishing village and to remove the nuisance of the ditch drain. The open masonry drain was altered into a barrel drain 3 feet in diameter and the ditch drain was replaced by a barrel drain of the same size. The works made steady progress during the year and all the works above enumerated were satisfactorily completed before the close of the official year at a cost of Rs. 20,274, leaving a balance of Rs. 2,056 to be utilized in the current year for providing an iron trough to carry sewage across the canal.

New water supply.

No steps were taken during the year to proceed further with the new water-supply scheme and by a pretty regular rainfall the necessity of pumping from the Red Hills tank into our channel, as will ordinarily be the case until our water-supply works are improved, did not exist. About $5\frac{1}{5}$ miles of mains of sizes varying from 1 inch to 9 inches were laid; 61 stop cocks, 24 valves, and 44 valve tap fountains were fixed during the year. The chief works were the new main from Kilpauk to Nungambaukum, which passes along Taylor's Road and McNichol's Road, and joins the 2-inch main in Nungambaukam High Road. A branch from this was also laid south along the Poonamallee Road for a distance of 2,470 feet, and another along Harrington's Road for a distance of 2,029 feet. This latter branch supplies water to two villages in Chetput, the inhabitants of which formerly suffered much from fever owing to bad water supply.

In addition to the above 1,288 yards of pipes were laid, and 11 stop cocks, eight valves, 12 fountains and jets, and four hydrants were fixed in the People's Park.

The Vice-President, Mr. J. A. Jones, submitted report and plans for the improvement of the water-supply of the city both in quality and quantity. The scheme was estimated to cost Rs. 11,82,636, and it provides for pumping station and engines, stand pipe, pumping main, settling tanks, filters and service reservoir, and finally a long main, 36 inches diameter, extending to Madras, a length of six miles, in substitution of an open conducting channel. The Commissioners resolved to submit the same to Government for their information and for criticism by their officers, and further finding that the municipal fund as at present constituted could not bear any very heavy additional burden upon it, resolved to request Government to recommend to the Government of India to grant them a loan of the amount necessary to carry out the scheme without interest repayable in 30 years or to pay them as a free grant a moiety of the cost of the scheme. The merits of the scheme were fully gone into by Colonels Hasted, Smith, and Shaw Stewart, but the Government whilst admitting the usefulness of the scheme, regretted their inability to help the municipality at present in its furtherance.

The Red Hills tank stood at a comparatively high level throughout the year. In respect to rainfall the year was an exceptional one. The rainfall registered was 39·12 inches.

The amount of water supplied to the city during the year was 312,136,983 cubic feet. This shows an increase on 1885–86 of 187,831,966 cubic feet. This is probably not an increase in consumption, but due to the repairs of the Government weir and more exact measurement. Applications for private service pipes continued to come in, and during the year 430 were laid, making a total of 3,072 houses supplied directly from the main. In addition, 113 services were extended and 518 repaired. Numerous complaints were received of defective pressure and of a bad smell arising from the water when freshly drawn, the first defect is due to want of head and the second to want of filtration, both these defects will increase as time goes on, because more water will be used and more vegetable and animal matter will pass into the pipes. There is no work more urgent than the improvement of our water-supply. The practice of placing meters on pipes where a large consumption of water was taking place was continued and 41 meters were fixed during the year. The amount of water used for non-domestic purposes during the year was 37,452,500 gallons.

Conservancy. The labour, bullocks, and carts have been, during the year under review, supplied under contract as hitherto. As the contract for supply of bullocks was to terminate on the 31st December 1886, fresh tenders had to be invited about the end of 1886. It was thought desirable for the better conservancy of the city that the supply of labour and bullocks should be by one man, and that the supply of labour and bullocks should be invited for division by division instead of by ranges, as was done on the previous occasion; and as the contract for labour did not terminate till three months after the contract for bullocks had terminated, tenders were invited for supply of bullocks for three years and three months and for supply of labour for three years only The difficulty arising from contractors failing to procure sufficient number of men for conservancy was more keenly felt during the year 1886-87 than in the previous year, as the number of absentees during the year was more than in the preceding year.

Mr. Jones, the Public Works Vice-President, while in charge of the Conservancy Department, drew up a very interesting and instructive report on the sanitary state of the City of Madras in March 1882, and in course of which he remarks as follows regarding the staff of coolies and carts allowed for the conservancy of the city:—

"I had wished I had time allowed to give particular examples of the deficiencies in each section, and to show what amount of work in several of the sections had to be daily neglected. What is done and what should be done will be found fully detailed in the tables attached to this report, which give full particulars as to staff and work appertaining to each section. The chief facts to be derived from these are first that our bullocks work about nine hours per day, and that the work required of them, viz., passing through streets, waiting for the collection of rubbish, depositing rubbish, &c., at depôts, passing between the depôts and their stables, will not allow of their travelling more than eight to nine miles per day. A rubbish cart will get full after passing over on an average one half-mile of street, though in some cases 500 feet will fill one. The amount they carry is about one ton, and this is collected from 1,000 people in the morning and from 2,000 people in the afternoon, or we may say that the same 1,000 people produce one-half ton additional during the day. This gives one and a half ton per 1,000 people daily. For the whole population of Madras it would be 600 tons daily, and to do this we would require 300 rubbish carts at two trips per day, and that would be, however, on the supposition that the garbage was equally distributed over the city and only on the basis of capacity alone. Some of the carts make two trips daily, some when the depôt is near at hand three. The distances to be travelled to some sections, however, are so great and the sections so large that the carts only pass through a portion of them daily, and I think it may be taken as a fact that not less than 300 rubbish carts will ever be found enough to carry off the rubbish of the city.

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"As yet I have dealt only with the collection of rubbish, but if our rubbish carts are deficient in number our sewage carts are more so. The drains and ditches in Madras amount to about 620 miles, while the staff for clearing filth, &c., from them is about 109 box carts, 287 side coolies, and 95 cesspool boys."

The foregoing remarks were embodied in a report submitted by the Vice-President with reference to G. O. No. 171, dated 7th March 1882, and the resolution of the Standing Committee dated 8th March, and although it was five years with March

1887 since these remarks have been made, the subjoined table will show to what a small extent has the conservancy staff been strengthened during this long period.

Years.	Rubbish Carts.	Box Carts.	Side Coolies.	Cesspool Boys.
1882 - - - -	223	109	287	95
1886–1887 - - - -	250	135	304	116

Assuming that, during the year under review, the rubbish carts ordinarily made two trips daily and during each trip the cart was full, there would have been 506 tons of rubbish removed, leaving 94 tons behind daily, which in course of a year would accumulate to 34,310 tons, and granting that according to the Vice-President's report the municipality has to clean 620 miles of ditches and drains, there is a box cart allowed for every 5½ miles, to remove the silt and for cleaning the drain a cooly for every two miles. Taking Black Town separately, wherein the new system of drainage introduced by Mr. Jones is fast approaching completion, it is considered that there are about 125 miles of drains which require cleaning daily, and for this purpose there were 56 sewage carts and 102 side coolies; that is a sewage cart for 2 miles and a side cooly for nearly 1¼ miles. These facts are stated with a view of showing clearly that even with the whole staff of conservancy working day after day the city cannot be kept clean, a certain number of streets and drains must daily be left uncleaned or cleaned only imperfectly, but on the contrary, as stated above, there are always a certain number of coolies absent from work, and on this account, during the year 1886–87, the conservancy arrangements suffered more than in any of the previous years.

In addition to the disadvantages arising from an insufficient and irregular supply of coolies, there are other difficulties in maintaining a satisfactory system of conservancy, and a few of these are here briefly referred to. First, there is no time fixed for throwing rubbish in dust-bins; although, under section 307 of the Madras Act, No. 1 of 1884, the Municipality is bound to provide dust-bins at suitable sites, there are still localities that have not been provided with dust-bins; but the number of dust-bins is being increased yearly. During the year under review 148 new dust-bins were fixed. With a deficient number of dust-bins there is nothing to regulate the time when rubbish may be deposited, people throw the rubbish at any time of the day, not uncommonly after the rubbish cart had passed by the street, so that the rubbish is allowed to lie there till the cart goes round that side again, which, owing to the insufficiency of the carts, may not be till the following day. Secondly, many of the drains are not provided with any pipes for getting them flushed satisfactorily. Even in places where there is a system of house conservancy in operation, a portion of night-soil does get into the drains. This arises from the peculiar habit of the people in using a large quantity of water for purposes of ablution and from the common practice so widely prevalent especially among people of Black Town, of allowing children to commit nuisance over drains alongside of streets and lanes. Section 318 of the Madras Municipal Act 1, of 1884, authorises the President to prosecute the parents of such children before magistrates, but to secure conviction the Municipal peon or any other Municipal officer must swear to having witnessed a child committing nuisance, and unless there be a peon attached to each of the streets, many cases cannot be detected; the moment the peon turns his back on a street to look after other parts of the section the street becomes to be used as a public latrine for children. Drains carrying such offensive matters like night-soil, &c., can never be kept clean and inoffensive if not properly flushed; it is not therefore till there is a good fall of rain that many of the drains can be said to have been cleaned.

The cost of the hire of carts, bullocks, and coolies supplied by contractors was Rs. 1,78,959-4-6, that is a monthly average cost of Rs. 14,913-4-5 as against Rs. 14,885-2-1 during the year 1885–86. The slight increase is owing to an increase in the staff of coolies during the year as well as to payment of higher rates for the coolies of North Range during the last quarter of 1886–87.

Vaccination.

The total number vaccinated during the year was 20,270, of which 19,220 proved successful, 450 unsuccessful, and 600 results unknown, as compared with 37,049, 788, and 752 respectively in 1885–86. Out of 20,270 cases vaccinated 19,220 were

successful, that is a percentage of 94·8 as against 37,049 out of 38,589 or 96·0 per cent. in 1885–86, and also out of 20,270 cases, 18,297 were primary and 1,973 re-vaccination. Out of the former 17,669 or a percentage of 96·5 were successful, as against 97·7 in 1885–86.

The bye-laws in use for enforcing vaccination differed during 1886–87 from the previous ones in two most important points. (1.) In the new bye-laws it is ruled that every infant need not be vaccinated until after six months of age, instead of within three months as under the old bye-laws. (2.) According to the new bye-laws, inspection of vaccinated children should be done in their houses and not at depôts as before; and these alterations have had a deterrent effect on the spread of vaccination. The number of cases of vaccination among children under one year has fallen, and there is also a slight increase in the number of cases wherein the result of vaccination could not be traced, and it is believed that both these are due to the changes introduced in the provisions of the bye-laws for compulsory vaccination.

During the year under review Madras was remarkably free from an epidemic of small-pox. There was only one case of death from small-pox in April 1886, as against 16 in 1885–86. This, no doubt, ought to be attributed to compulsory vaccination.

Of the 12,073 children vaccinated under one year, 9,284 were reported as born in Madras, and the remaining 2,789 in Mofussil stations, which no doubt is partly due to mothers going up-country for confinement, and returning to Madras after confinement. It is invariably a practice among Hindus that the first two confinements should, if possible, be in the houses of the mothers of the pregnant women, and accordingly some will no doubt come to Madras for confinement, but as vaccination is made compulsory only after six months of a child's birth, the mothers by that time return to their houses, and hence children of such temporary residents in Madras are not brought to the notice of the vaccinator.

For every 100 of population 5·09 resort to vaccination. A larger proportion of the Hindus are being vaccinated year after year, 5·71 per 100 of that class were vaccinated against 3·61 among Mahomedans and 1·93 among Christians in 1886–87.

Vital statistics.

The census population of 1881, which forms the basis of the computation of the birth and death rates, consisted in the enumeration of only those persons that ordinarily spent their nights in Madras. No account has apparently been taken of the large number of clerks, labourers, and others that daily flock to this city from adjacent villages, who spend nearly the whole day in the city, but return home to their villages during nights; the day population would therefore exceed the night population; whereas the computation of the birth-rate and the death-rate is based on the night population irrespective of the increase during the day. Moreover, the large hospitals and the institutions for paupers and lepers attract many from outside who, if they happen to die in Madras, swell the number in the death register. Taking the population of 1881 to be 398,777 there is an increase of 2,301 during 10 years, but, as it has been established beyond a shadow of doubt that the census of 1881 has been more accurate than that of 1871, and in consequence the enumeration in 1881 disclosed a large increase in the female population, it is difficult to draw any conclusion regarding the rate of increase annually, and the computation of birth and death rates has therefore been based on the census of 1881.

Inclusive of still-born, there were 15,976 births registered during the year 1886, equal to 40·0 per 1,000 of population, as against 16,108 or 40·3 in 1885, and 15,573·8, the average of 10 previous years.

Of the total births 8,256 were males, and 7,720 females, that is, during the year there were 109·9 male births registered to 100 of females, and comparing this with the results of the preceding five years, it is found in Madras that the male births are generally in excess of female births. Granting that the disparity in age between husband and wife tends to develope a tendency for the preponderance of male births over female births, nowhere is the disparity between the ages of the married couple so great as in Madras. It is highly probable that the heavy mortality among infants under one year of age may also be partly attributed to the tender age at which girls are given away in marriage in this country.

During the year there were 14,699 deaths as against 14,925 registered during 1885, giving an annual death-rate of 36·8 per 1,000 of population as against 37·4 of 1885, and 39·6 the average of 10 previous years. It is gratifying to note that there was no epidemic of small-pox or of cholera, but during the whole year there was only one death from small-pox, and four from cholera.

The following is a statement of deaths from the most prevalent diseases during the year as compared with 1885 :—

Years.	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.	Total.	Other causes.	General Total.	Ratio per 1,000.
1885 - - -	26	67	3,595	2,807	184	6,679	8,246	14,925	37·4
1886 - -	1	250	3,801	2,586	4	6,642	8,057	14,699	36·8
Average of 10 previous years.	1,088·7	91·3	3,504·0	2,461·5	529·5	7,675·0	8,138·6	15,813·6	39·6

Death from fevers exhibits higher figures than in 1885, and the mean of 10 previous years; and, excepting deaths from measles and fevers, deaths from every other form of disease have been less than in the preceding year.

The death-rate was highest in the first division (41·9) and lowest in the sixth division (24·5). Although the first division is one bordering on the sea, its death-rate has always been high, and it has decidedly been highest during the past two years of 1885 and 1886. It does seem probable, as surmised in the last year's report, that this high death-rate in the first division is due to its containing a large collection of parcherries, which form the plague spots of the city. The death-rate has decidedly gone down in the year by 3·9, when the decline in the total death-rate of the city has been only by 0·6. This decrease, it is believed, was owing to the removal of a parcherry close by the Robinson's Park. The parcherries in Madras consist principally of thatched huts of a conical shape, the floor measuring about 8 feet in diameter, and generally not more than 8 feet in height. The entrance is 2 feet by 2 feet; this is all the opening the hut has; and it has always been a matter of surprise how a family, consisting generally of about five persons, lives in one of these huts; and these huts are placed together as closely as possible, having no regard for ventilation. With want of fresh air, the soil on which these huts stand is contaminated with filth and organic matter year after year. These huts are so irregularly built that anything like proper conservancy, and far less any introduction of drainage, becomes impossible, and to use the words of an eminent authority on the sanitary condition of Madras, "they invite and "foster epidemic diseases, and thus increase the death-rate for the place as a whole, "and otherwise nullify the beneficial influence of sanitary improvements; and Madras "is not exceptional as regards density of population, for all our towns have their "wretched parcherries, where the poor are far too thick upon the ground;" and it must here be stated that, though the first division covers an area of nearly 5·31 square miles, still it is largely interspersed with these crowded slums, and a large portion of the division is quite uninhabited. The lowest death-rate is found in the sixth, which contains a large number of European residents, and there is little room for doubt that, but for the overcrowding and its concomitant evil influences on public health in other parts, the mortality of the whole city need not be much higher than it is in the sixth division, which is 24·5 per 1,000. It will, perhaps, be surprising that divisions like the fourth and eighth should show such high death-rates as 40·8 and 38·5 per 1,000 respectively, and in point of unhealthiness these rank next to the first division, and appear more unhealthy than Black Town (second (36·6) and third (36·0) divisions) which forms one of the most crowded centres of the city, the principal reason being there is no outlet for the sewage of these divisions—fourth and eighth. With the want of drainage there was no proper supply of Red Hills water during the year in the fourth division, and the Red Hills water of the eighth divison gives out such a bad smell that the people are driven to get their supply of drinking water from wells and tanks. In the eighth division a small portion of Royapettah is drained, and the sewage directed to a farm close by; but the most populous parts of the division (St. Thomé and Mailapur) have no system of drainage. They have become almost riddled with upwards of 200 cesspools, which are a source of standing nuisance to the public, besides acting most injuriously on the health of the residents.

Next to the eighth division in point of unhealthiness is the seventh (38·0) which is largely populated by Mahomedans, who do not live in storied houses, but in thatched huts built on the ground, and in certain places so many as 19,446 persons are crowded together over a space of about 125 acres. The division is well drained compared with the other divisions, though some of the crowded centres of the division are but imperfectly so, and though the side drains that exist cannot be said to be impervious. The sewage is partly diverted to Napier Park, but mainly to the

Kistnampett Sewage Farm, where it is used for irrigation. As the system of drainage introduced in Black Town, which includes the second and third divisions, has not yet been completed, though fast approaching completion, it is difficult to say what effect it has had on the public health of these divisions; but according to the results of the year 1886 these appear more unhealthy than the fifth division, which is not half so well drained, and where there is no system of conservancy in operation for removal of night-soil. So far as can be seen, this result is owing to the fifth division containing a larger proportion of Christians than in the second or third division, and less of Hindus and Mahomedans.

Out of 1,709 deaths among Mahomedans in Madras, 789 occurred in the seventh division, that is, almost half the number of deaths occurred in the seventh division among Mahomedans who constitute little less than the third of the population of the division. It will also be seen from the aforesaid statement that the second division, with the largest Hindu population, returns the largest number of deaths among Hindus, and the fifth division, with the largest Christian population, returns the largest number of deaths among Christians. Facts such as these prove how far the registration of deaths is accurate. According to the results of the year 1886 the Hindus return a death-rate of 39·1 per 1,000, the Mahomedans 34·5, and the Christians 21·7. That there should be such a difference between two communities (Hindus and Christians) the wants of which are equally well attended to by the Municipality, show clearly that the defects in sanitation that really keep such a high death-rate among Hindus have been practically beyond the reach of the Municipality; the defects principally consist of defects of house sanitation resulting from overcrowding and insanitary habits. Under the term Hindus are included all professing Hindu religion, such as the Shanars of Tinnevelly Settlement, Oobras, Chucklers, Pariahs, &c. To effect any real improvement in house sanitation we must wait till, with the spread of education and enlightenment, the general masses begin to appreciate and observe the laws of health. It is already observed that educated members of the native community day by day become alive to the importance of pure air and pure water.

Of the 14,699 deaths, 7,296 were among males, and 7,403 among females, and these figures, when distributed among the different classes of population, are as follow :—

Sex.	Europeans.	East Indians.	Native Christians.	Hindus.	Mahomedans.
Males - -	46	134	229	6,105	782
Females - -	28	133	280	6,035	927

Among Europeans there are more deaths among males than females, which is probably due to European ladies spending a greater portion of their time in the Hills and in England. The mortality among East Indians is nearly the same in both sexes, because among this community a greater portion of them do not spend their time at home but are engaged in some active occupation, and are thus exposed to the incidents of out-door life as much as the males. The same may be said of Native Christians, who, perhaps, having somewhat weaker constitutions than their Eurasian sisters, succumb more readily to ailments than the latter are able to withstand, and thus show an excess in the death-rate among females over males. Among Hindus the males return a higher death-rate than females, and among Mahomedans there is a higher death-rate among females, which is principally due to the Mahomedan woman spending a greater portion or whole of her lifetime in close, ill-ventilated rooms. According to the custom of her nation, a Mahomedan woman cannot go out in public. Inside or outside of her house she must be in closed atmosphere, and when she is overtaken with any illness there is no chance of a medical man examining her; the meetings between the doctor and his patient are through a purdah. Under such peculiar circumstances it need not be surprising that the mortality among Mahomedan women has always been higher than among the men of the same community.

The mortality among infants under one year of age continued high (5,122) during the year, and the causes having been already mentioned in the report of last year, they need not be repeated here. Under one year, more male children have died than female, and between one and 15 years of age the number of deaths among females is slightly in excess of males; but between 15 and 30, which is the child-

bearing period for women, the deaths among them are, not a little, but greatly, in excess of deaths among males. From 30 to 60 more males die than females, and over 60 more females die than males.

The principal diseases that were prevalent in Madras during the year 1886 are now very briefly reviewed.

Small-pox.—There was only one case of death registered in April in fifth division as against 26 in 1885. It seems clear that for two years the city of Madras has enjoyed comparative immunity from this dreadful malady, which used to ravage so fearfully prior to the introduction of bye-laws for compulsory vaccination under Section 378 of the City of Madras Municipal Act, No. 1 of 1884.

Cholera.—There have been four deaths, three in second division in February, and one in fifth division in April, registered under this head. The house where the three cases of cholera occurred (second division) was described in the following terms in the Health Officer's letter to the President of the Board of Health, dated 9th February 1886:—"These cases occurred in house No. 63, Thirupally Street, second division, "Centre ward, the street long and narrow, and the locality is one of the most filthy "places in Black Town. At the western extremity of the house there is a sewage "farm, and just adjoining the street a vacant ground used for deposit of dry rubbish. "The ground is surrounded on three sides by huts where Pariahs and Chucklers live, "the fourth side opens towards the street; the nearest Red Hills water pipe is about "72 yards distant. This water was said to be in use for drinking purposes by the "people of the house. In the house, which is 94 feet long and 38 feet wide, there "live 16 separate families, consisting in all of 52 souls. For all these people there "is only one latrine, 8 by 6 feet; it is in the front part of the house close to the "street; the well in the rear of the house, in an open court-yard which is used for "bathing and for washing dirty clothes" Here, again, is another instance of over-crowding, and when an attempt was made to prosecute the owner under Section 324 of the Act, the house was vacated.

Fevers.—There have been so many as 3,801 deaths from fevers out of 14,699, that is, 25·8 per cent. of the total deaths in the city during the year may be attributed to fevers. The disease was most destructive in January. It showed a tendency to decline till June, when there was a tendency to rise, with a slight fall in October. From January to June the deaths from fevers have been less than in the corresponding months of 1885, and then exceed with the exception of the number returned in November.

Bowel complaints include dysentery and diarrhœa, and the number of deaths returned during 1886 was 2,586, as against 2,807 in 1885, and 2,461·5, the mean of the past decade. There were 1,601 deaths from dysentery, and 985 from diarrhœa.

Other diseases.—There were 8,057 deaths, as against 8,246 of 1885, and 8,138·6, the mean of the previous ten years.

ABSTRACT OF REPORT OF THE BOMBAY MUNICIPALITY FOR 1886-87.

(*Mr. F. L. Charles, Acting Municipal Commissioner.*)

Public Works.

Water Supply.—In the Administration Report of the last year, paragraph 35, the progress of the Tansa scheme was noticed, the scheme providing for a daily supply of 17 million gallons. In addition to the contracts let in 1885-86, the contract for the remaining important work, *viz.*, the *Duct Line*, including tunnels, was given to Messrs. Walsh, Lovett, Mitchell & Co., on 28th July 1886, with the approval of the Town Council, at rates which bring the total approximately to Rs. 42 lakhs. Fair progress was made in the construction of the dam, and though the masonry work done during the year is less than what was expected, owing to the confined position in the river-bed, yet a very large quantity of excavation for foundations has been done, which will admit of greater progress being made with the masonry in next year. No difficulty has been found in acquiring the land required for the lake and duct, that work being entrusted to Rao Saheb Vishnu Ramchandra, an officer lent by Government, who has carried out his instructions with energy and tact. Owing chiefly to his arrangements it has not been found necessary to apply the Land Acquisition Act in any case as yet. The total land acquired up to the end of the year was 1,368 acres and 13½ guntas, at a cost of Rs. 30,241. 2. 3, including compensation for houses, trees, and embankments. This gives an average of Rs. 22. 1. 7, per acre of 4,840 square yards, or nearly 14 square yards for one anna, affording an example of the extraordinary difference between the value of land up country and its value in Bombay.

Owing to the monsoon of 1885 being an unusually light one, the Vehar Lake was not filled, and on the 11th June 1886 the level of the water had fallen to 46·60 feet on the gauge, the height of the level of overflow at the waste weir being 60·00 feet. But fortunately the monsoon of 1886 filled the lake to the point of overflow as early as 24th July 1886. The Tulsi Lake also overflowed on the same day. This early overflowing was principally due to the heavy monsoon of the year under report, as much as 26·78 inches falling in the week ending 17th July 1886, followed by 11¾ inches in the succeeding week, coupled with the fact that a large quantity of water was added to the lakes from the catch water channels recently constructed. The importance and utility of these works are now apparent, and the Executive Engineer suggests that, in view of the limited supply of water in the city till the arrival of Tansa water and the increasing demand, the question of extending the present catch-water channels and constructing new ones should be considered, and he suggests this in view of the uncertainty of the rainfall—some seasons not affording sufficient rain to fill the lakes. There is much force in his remarks, and surveys will be undertaken to see if further catch-water channels will be of advantage.

The new 24-inch main has considerably relieved the inhabitants of the northern portions of the Island, and hardly any complaints of want of water were made from this district during the year. The construction of the filter beds at Vehar has also been completed.

The work of the raising of the dams of the Tulsi Lake was finally completed during the year, and though, as stated above, the lake was filled to its extreme capacity and water overflowed the waste weir on the 24th July and on several subsequent days, the new work stood the test without showing any signs of weakness.

Malabar Hill Reservoir Roofs.—These works are practically completed, though the storage basin was not ready to receive water till after the end of the year. The contract time for their completion expired on 31st December 1886, but an extension of time was allowed, as, owing to the requirements of the public convenience, the storage basin was not given into the charge of the contractors as soon as they were prepared to go on with the work. Owing to constant complaints of a scanty supply of water to the inhabitants of the high-level districts on Malabar Hill and Cumbala Hill, an engine and pump were erected close by the reservoir. These were started on the 4th June 1886, and have worked regularly from that time to the great advantage of the localities supplied.

In almost all the streets in Kamathipura, and in the majority of streets in Khetwadi, and in various other streets, new mains were laid during the year; and the work of detecting waste of water from faulty mains, service pipes, and fittings has been

vigorously carried on, and has achieved most satisfactory results. The water waste prevention operations form the subject of a separate correspondence, which has since the close of the year been laid before the Town Council. The results are briefly these, *viz.*;—a daily waste of 600,000 gallons has been discovered and checked at a cost of less than 1 anna per 1,000 gallons, the value of the water at cost price being at least 4 annas per 1,000 gallons, and when the full staff asked for has been sanctioned and brought into working order, it is confidently expected that $2\frac{1}{2}$ million gallons a day will be saved and added to the quantity available for distribution, the annual value of the water saved being Rs. 2,28,000. The great importance of this measure lies in the fact that until the arrival of the Tansa water (which will add 17 million gallons per diem) our supply as dependent on Vehar and Tulsi Lakes only amounts to $14\frac{3}{4}$ million gallons per diem, so that the quantity to be saved by the waste prevention operations amounts to $\frac{1}{6}$ of the total present supply.

The net increase in the number of connections during the year was 417, involving an increased consumption of over 2 lakhs of gallons per day. At this rate of increase, it will be a most difficult matter, even with the utmost possible care, to comply with the requisitions for new connections up to the time when the Tansa water is available.

Drainage and sewerage.

The Storm-Water Drainage Works, including the Reservoir, on the Flats were referred to in Mr. Ollivant's Administration Report of last year, paragraphs 37 to 41 as having been practically brought to completion. Full descriptions and explanations of their object and design were given there, and it is unnecessary for me to say more than that the results have been most satisfactory in freeing the portions of the city affected by the works from flooding. As Mr. Ollivant remarked last year, "places which formerly "were knee-deep in water for many hours after a comparatively moderate fall of rain, "are now dry in a very short space of time."

The Queen's Road Intercepting Sewer having been finally completed, the Back Bay nuisance has been stopped for the greater portion of the year by discontinuing the discharge of sewage into Back Bay during the dry weather. During the rains, however, the sewage must continue to be discharged into Back Bay until the completion of the sewerage system of the districts bordering on the Queen's Road. The Corporation have, since the close of the year, sanctioned the sum required (Rs. 11,14,929) for these works, and operations will be pushed on as rapidly as possible.

Clerk Road Branch of Main Sewer and Pipe Sewers in De Lisle Road and Arthur Road.—The advantage of these works is now very apparent, connections in large numbers having been made from houses which would otherwise have had no drainage at all.

Sewerage of Kamathipura.—These works have been completed, but the sweepers' passages are not all yet in the condition desired, because, since the completion of these works, many new houses have been built, and many new nahanies and privies have been constructed, in which the house-owners have not connected their nahanies and privies (the latter so far as ablution-water is concerned) with the sewers on the new principle. Steps are being taken to compel the owners of these houses to do the necessary work. The work for house connections, *i.e.*, for sullage and ablution-water in this district was divided into two separate contracts—one for the supply of castings and the other for the execution of the work. The time for the expiry of the contract for the execution of the work was fixed with regard to the time for the supply of castings, but the contractor for the supply having failed to deliver the castings in due time, the other contractor declined to proceed with the work. Under the terms of the contract, the work was then departmentally finished at the risk of the contractor for the supply of castings.

Ovoid Sewer from the Crawford Market to the Mint.—This work is nearly completed, though, for reasons given in the previous Administration Report, the progress has not been what it ought to have been. The portions that remained to be done at the end of the year were a length of about 100 feet near the Victoria Terminus, the work of crossing two ovoid drains near the Mint, and of making the connection with the large ovoid drain near the Town Hall, and fixing a penstock there. The whole will be completed by about December 1887. The completed portion of this sewer has already been brought into use; the sewage of the Cama Hospital being admitted for the first time on July 30th, 1886.

The Ripon Road Sewer and Pipe Sewers and House Branches in the Agripada District have been completed, but the accounts of the latter have not been finally closed because the contractors for the works claim payment of the full contract amount notwithstanding numerous reductions in the work. Mr. Forde, the late

Consulting Engineer to the Municipality, who was appointed arbitrator, gave his award in May 1886, in favour of the contention of the Executive Engineer, but the contractors disputed the award, and the matter is still unsettled; the difficulty of arriving at a decision being, of course, much increased by the unfortunate death of Mr. Forde.

The Fort Pipe Sewer Works are in progress, and the contractors are doing the work to the satisfaction of the Executive Engineer and with credit to themselves. It is hoped that the sewers will be ready for the reception of sewage by December 1887, or soon after that date, and I confidently expect that house-occupiers in the fort will derive the greatest benefit from the introduction of the new system of connections with its carefully designed arrangements for preventing the entry of sewer-gas into houses. The cost of the work already done has been Rs. 1,63,959.

The works in connection with the Girgam and Kamathipura Night-soil Depôts are completed, and I am glad to say that the arrangements work very well. The necessity for further depôts on the same plan is being considered. Other minor works are described in the Executive Engineer's Report.

Attention is requested to the skeleton map in the beginning of the report which has been specially prepared to show at a glance the progress which has been made up to date in carrying out the sewerage system adopted by the Corporation in 1878. It will be observed from this map that the Nagpada, Mazagon, and Parel Districts have not as yet been touched. The necessity of providing for these districts was alluded to in para. 42 of Mr. Ollivant's report of last year, and I propose at an early date to ask for the necessary funds to commence the surveys and preparation of the plans and estimates for the sewerage of these districts

The total sum sanctioned up to the close of the year on Sewerage Works (of course not including storm-water drains) since 1878, has been about 33 lakhs, out of which, work costing about 23 lakhs has been completed. About 10 lakhs worth of work is in progress, to which must be added in next year's report the 11 lakhs sanctioned since the close of the year for the pipe sewers and sullage connections of the Queen's Road District. The house connection work (for sullage and privy ablution water only) in Khetwadi has been carried on departmentally, owing to the absence of tenders at reasonable rates. The experience of the year shews that the Engineer has been able to carry out the work within the rates estimated. These works consist of the provision of iron down-take pipes to carry off bath-room and privy ablution water, together with syphons and ventilating shafts to prevent the entry of sewer-gas into the houses.

I am glad to say that, from all the houses at which the work has been done, only one complaint was received, and in that case it was found on inquiry that through a mistake on the part of the Inspector, the work was not executed in accordance with orders. The mistake was easily rectified.

Roads and buildings.

The rapid extension of building operations in Bombay may be inferred from the following table:—

	Building operations sanctioned.
1883–84	607
1884–85	763
1885–86	823
1886–87	983

Thus the number of buildings proposed to be commenced in the year under report was one-third more than in 1883–84.

One of the chief improvements carried out during the year was the formation of a large circle on the Flats, formerly known as the Central Station, at the intersection of the roads. This circle has an area of 10,084 square yards, and has greatly improved the locality. It has been named Jacob's Circle, after General LeGrand Jacob, and the promoters of his Memorial Fund are putting up an ornamental fountain in the centre of the Circle. The fountain is of Jeypur marble work, and will be completed in 1887–88.

Other important street improvements were carried out; prominent amongst these were the widening of Thakurdwar Road, the widening of Tardeo Road near the Manekjee Petit's Mill, the improvement of Breach Candy, now Girgham Road, near Kennedy Bridge, and the improvement of Breach Vellard Road.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1886.

(Surgeon-Major T. S. Weir.)

The year is memorable in our sanitary history as being the year of the smallest number of deaths, both from cholera and small-pox, yet registered in Bombay, 19 deaths from both causes happening. The only years of low mortality from cholera and small-pox nearly approaching 1886 are 1874 and 1881. The death-rate is 23·2 per 1,000, and probably really a little lower, considering the extraordinary expansion of the city and population. The public health may be considered to have been good during the year 1886. Contrasted with the previous year, there has been a reduction of mortality from all the chief causes other than one.

The total deaths, the rate of mortality of males and females, and the proportion of male to female deaths in each year from 1881 to 1886, are contrasted in the table following :—

Years.	Total Deaths.	Death-rate.		Proportion of Male to Female Deaths.
		Males.	Females.	
1881	21,856	24·94	33·27	112·97
1882	20,468	23·36	31·14	113·05
1883	23,530	26·62	36·16	119·00
1884	22,542	25·29	34·96	109·01
1885	21,850	24·58	33·80	109·57
1886	20,074	22·45	31·24	108·27

I have in previous reports referred to the density of population, and discussed the influence of that density on the vitality of the population. The density of population has not been relieved by the numerous buildings erected to the north through Byculla and Parell, and over the reclamation on the eastern foreshore. In the densely populated sections, not only is the open land being built over, but the piling of buildings continues. The cause of the density of population, apart from business causes and class influences, is not want of space, but want of communication; there is ample space, but there are not ample ways of approach. The section of Mahim, having 930 acres, has only 18 persons to a square acre. The section of Sion, having 4,248 acres, more than one-fourth of the whole island, has only 4 persons to a square acre. The section of Worlee, having 1,479 acres, has only 9 persons to a square acre. The section of Sewree, having 427 acres, has only 12 persons to the square acre. The section of Parell, on the borders of the areas of density having 1,108 acres, has only 16 persons to a square acre. These five sections of Worlee, Mahim, Parell, Sewree, and Sion, covering the northern confines of the island, having an area of 8,192 acres, a little more than one-half of the island, have only 8 persons to a square acre. The space within the island is ample, but it cannot be made use of for want of communication. The city is compressed, not for want of space, but for want of communication. In the north-east valleys the island has more the appearance of the distant country than of the suburbs of a great city; many acres of ground may be walked over without seeing building other than the leaf-hut of the gardener. The Government have not too soon determined to consider how the extension of the city is to be encouraged, and the expansion of the population is to be guided, and appointed a committee to report. The question is as much of preserving the population from themselves, as of guiding the growth of the population of the new city.

The density of population in some portions of the city is now much greater than in 1881, when the census was taken. There is room for the population and for the greater city of the future on the island, if only the doors of communication are opened. The reality to be understood is, that 37 per cent. of the population live on 3½ per cent. of

the surface of the island, that in 12 sections the lowest number of persons to an acre is 254, and that in five sections, covering more than half of the island, there are only 8 persons to an acre.

I have had to draw special attention to the appalling nuisances from imperfect drainage and want of drainage, from population on land not prepared for population, amidst the buildings inside the old race-course, and on either side of the Ripon Road. The construction of the new sewer in De Lisle Road has prevented the development of equally serious nuisances on the side of that road.

The disposal of the sweepings is a very pressing question. In the special report of 1884, I have given my views on the question; the question has not changed much so far as the means of disposal, but the place of disposal on the Flats is nearly at an end. In connexion with the treatment of town sweepings, I would point out, as an instance of the advance of sanitation in India, that we, notwithstanding the trade refuse produced and to be dealt with, have really now, in proportion to population, a less number of scavengers than a city such as Panahhas.

According to place of birth, the deaths in this year amongst persons born in Bombay are greater than the deaths in the immigrant population. The mortality in the indigenous population is 762 more; 10,336 persons born in Bombay died, against 9,574 not born in Bombay. In the previous year the mortality of the indigenous population was less than amongst immigrants by 179 deaths, and in that year the excess in the immigrant mortality was greater than in 1884. The fluctuation of the immigrant mortality indicates the seasonal fluctuation of population, such as we believe it to be, whereas the incidence of the indigenous mortality is affected by different causes; there is a marked fall as in the previous year, indicated by 128 deaths less during June in the mortality of immigrants, while in the same month the second highest fatality of indigenous is registered. The months of highest total mortality were May, July, October, January, and April, and the months of fewest deaths November, December, and August. The high April and May mortality was due to the fatality from measles.

The mortality arranged in groups of important death causes is exhibited in the table following; contrasted with the preceding year there is a reduction in the mortality from the following causes:—small-pox, fevers, cholera, dysentery, diseases of the respiratory system, phthisis, and diseases of the nervous system, and an enhancement from measles and diarrhœa. These figures indicate a generally improved state of public health. In the results of diarrhœa and dysentery there is an increase of 95 deaths from diarrhœa, but a decrease of 124 from dysentery. Carrying the comparison still further to the average of the five years preceding, there is a reduction of mortality from small-pox, fevers, under the classes—remittent 362 less—and ague 273 less—cholera, diarrhœa, dysentery, phthisis, and diseases of the nervous system, and an enhancement from measles and diseases of the respiratory system. Referring to the reduction of mortality from diarrhœa and dysentery in 1885, I wrote: "It is "possible that the mortality from these diseases has been influenced by the system of "channels constructed to remove sewage and to carry away the rain waters and "drainage, but which for a considerable period acted as sub-soil drains and channels. "The new rain water channels with the disused, empty of sewage, underground "sewers of past systems and expedients, must prove valuable soil purifiers."

Return showing the Number of Deaths from different Causes in 1886.

Causes of Deaths.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Small-pox	19	·02	Annual increment of population is calculated.
Measles	572	·66	
Fever	5,820	6·74	
Cholera	19	·02	
Phthisis	2,674	3·10	
Diseases of Nervous System	1,984	2·30	
„ Respiratory „	3,810	4·42	
Diarrhœa	1,032	1·20	
Dysentery	484	·56	
Accidents	389	·45	
All other causes except Still-born	3,271	3·79	
Total	20,074	23·26	

The districts or sections in which the highest mortality has occurred are 2nd Nagpada, 38·06; Tarwadi, 37·40; and Kamathipura, 35·77. I exclude Upper Colaba, as the high rate of mortality in that section (38·71) is due to exceptional causes; of the 111 deaths in Upper Colaba, including the barracks and rest-houses for troops on passage, 24 occurred amongst strangers who had been under one month in the section; of the 28 European deaths, 23 occurred amongst Europeans under one year in the section. I exclude the high mortality of Upper Colaba for the same reasons as I exclude the low mortality of the Fort South (7·11), and Esplanade (12·92), the mortality in both sections being fictitious so far as representing the chances of life in each locality. The low mortality in the Fort South is an instance of the erroneous conclusion that may be drawn from the total mortality. In the previous year the highest death-rates were registered in the Chuckla section and in 2nd Nagpada; in this year the highest mortality is registered in 2nd Nagpada, but the mortality is less than in the year preceding and the mortality in Chuckla is also less. It will be observed that the mortality is high, and further higher than in the year preceding in the section of Tarwadi; the mortality is 37·40 against 36·37 in 1885. I believe that the rate of mortality in Tarwadi is due more to increase of population than to the insanitary conditions within the district; the population of this district is expanding rapidly; numerous buildings have been erected within the last five years. The same explanation is applicable to Parell (32·05).

But while there is reason for believing that the chances of life are better in some of the sections than the figures of mortality indicate, there is equally good reason for believing that the chances of life are less favourable in some other sections than the mortality tables lead us to hope; for instance, the death tables of the Fort, Market, Mandvi, Oomerkhari, Dongri, Bhuleshwar, and Kumbharwada, indicate more favourable sanitary conditions than exist in these portions of the city. I am far from believing that the chances of life in the Fort, Market, Mandvi, Oomerkhari, and Dongri, are fully as good as represented in the mortality tables. There exist in these districts the most unwholesome local conditions, imperfect drainage, dangerous because imperfect and covered, imperfect drains without and within buildings, and house-crowding. But we have in these districts other conditions affecting the total death ratio, and they may generally be stated to be—class of population, and the class of population indicates conditions of life and opulence, proportion of males to females, position of section, openness, exposure, room-crowding. The house and street drainage of the Fort is most imperfect and dangerous, in many of the Fort buildings drains are inside the buildings, and directly joined to the street sewer. The most putrid sewer vapours I have experienced in buildings in the Fort. A system of street drainage in the Fort is being carried out, and I hope will soon be completed.

The section in which the highest mortality has been registered (2nd Nagpada) is undoubtedly a district of most insanitary conditions. There is in this section as many as 67 persons to each house on an average. The house-crowding in this section is the greatest in Bombay. Although in this section there is the greatest number of persons to a house, and the greatest number of families to a house, there is not the highest average number of persons to a family. Although the number of houses to an acre is only 6, the average of persons to an acre is 469. There is this dense house-crowding, but the means for overcoming the effects of this crowding are imperfect; house ventilation and air spaces within or without are not sufficient, the channels to carry away the liquid refuse are imperfect in construction and repair, and of unequal gradients and underground. We have in this district intense house-crowding and bad drainage, and bad house ventilation. The drains are very imperfect, and in some lanes the roadway has to be opened several times each week to remove obstructions. The superficial underground drains are tracks in which sewage trickles from the houses. And further, beyond these conditions, a large proportion of unwholesome and disease-susceptible classes.

The mortality of Kamathipura, although less by nearly 3 per 1,000 than the death-rate of 1885, is still high—higher than I hope it will be in the future; much still remains to be done to improve the sanitary conditions of Kamathipura. The male mortality in Kamathipura is 4·8 less, and the female ·5 per 1,000 less, than in 1885; the male mortality is the lowest registered within five years, while the female is higher than in 1882, but lower than in the three succeeding years. The chief reduction of male mortality has been registered over 12 years of age; from 12 to 40 years the male mortality is 7·2 less, and over 40 it is 3·8 less than in 1885, while under 12 it is ·53 more. The chief reduction of female mortality has been registered over 40 years, at which period of life it was 4 less; from 12 to 40, the female mortality was 2·5 less than in 1885, while under 12 years, it was 5·6 higher.

The chief death causes from which the mortality of Kamathipura is in excess of the average death-rate are, fevers, diseases of respiratory system, diarrhœa, and dysentery; the greatest excess is under diseases of respiratory system, 3·3 per 1,000. I have in former reports referred to the excess death-rate from diseases of the respiratory system. This excess indicates very clearly the insanitary conditions in this section; there is great pressure of population and very imperfect house ventilation, acting on very disease-susceptible populations, and a large proportion of the population living on ground floors. I remember when the foundations of the municipal milch cattle stable in Kamathipura were being excavated, the foul ooze that came to the surface—ooze of ancient and decomposing refuse preserved from complete change and innocuousness by layers of covering earth; and it appeared to me an excellent illustration of the danger of deeply disposing of and encasing sweepings. It is well to remember the ancient condition of Kamathipura—previous to the time of road lines and reclamation, when a swamp with elevations on which were huts, and between which lay ditches. The foulness, as in the case of the land under the milch cattle stable, has been covered and concealed, but not removed by reclamation. In other portions of the city reclamation—equally dangerous reclamation—had been effected. I understand that the ditches of Kamathipura were largely filled with garbage. The house connexions for sullage have been completed, following on the completion of street drainage at an earlier period. It will be possible to appraise in some measure at the end of this year the effects of the drainage completed, but beyond drainage there are other improvements, especially in house ventilation, to be carried out. Still the result so far indicated by the fall each year since 1883 in the total number of deaths has been a yearly improvement in health. I do not contend that the decrease in the total deaths is solely ascribable to improvement of local conditions, for there are fluctuating elements within this section which may influence the course of the annual mortality, raise or depress the death-rate, independent of local conditions.

As in the previous year, the mortality of male children under one year of age is higher than of female children, while the mortality of female children during the early period of life in the following years from 1 up to 5 is higher than of males. Between 5 and 6 is the last life period until 45 is reached, during which the mortality of females is less than males. The mortality of male children under 1 year is 18 per 1,000 less, and of female children 11 less than in 1885; taking the deaths of all children under 5 years of age, the mortality of males is 30 less and females 25 less than in 1885. The total deaths of infants, male and female, under one year (5,962) are 347 less, and the total deaths of children under 5 years of age (8,971) are 533 less than in 1885. This is a large reduction of infant mortality, and a very favourable indication. The percentage of deaths under 1 year to population of the same age is equal to 26·3 against 27·8 in the year before, and to total deaths 29·70. The proportion of deaths under 1 year to children living was 28 in 1884, 27 in 1885, and now 26 in 1886. The percentage of deaths to births is 39.

There is a certain agreement between the incidence of the total mortality and the mortality of children on districts; in the districts of the highest total mortality we find a high rate of infant mortality and a great destruction of infant life. The average mortality of children under one year of age for the whole island is 26 per 100, and in 2nd Nagpada and Kamathipura it rises to 36 and 39. The infant death-rate in 1st Nagpada fell 10 per cent. in 1886 and in Chuckla it has fallen nearly 7 per cent.

Return showing the Number of Deaths and Rate of Mortality at different Periods of Life under Five Years of Age.

——	Deaths, 1885.	Per 1,000 of Population.	Deaths, 1886.	Per 1,000 of Population.
Under 1 year -	6,309	278·71	5,962	263·38
„ 1 to 2 years -	1,785	113·01	1,744	110·42
„ 2 to 3 „ -	770	54·65	675	47·91
„ 3 to 4 „ -	367	26·81	348	25·42
„ 4 to 5 „ -	273	17·55	242	15·56
Total -	9,504	116·25	8,971	109·73

The mortality from small-pox is extraordinarily low; only 19 deaths were registered, being 332 less than the average of the previous five years; this is the lowest mortality yet registered. 1881 is the only year in which a mortality from small-pox, nearly as low, has been registered. The indications of a resuscitation of small-pox, which have generally been observed in the period preceding an epidemic, must be carefully looked for towards the end of 1887. I apprehend the occurrence of an epidemic of small-pox in 1888, from certain indications I observed late in the hot season of this year, and if cases of small-pox occur in the monsoon months of 1887, they may be considered, judging from previous experience, as of grave import. I pointed out in previous reports the danger that exists from unprotected adults and infants, and such danger has been manifest in previous epidemics. It is necessary that the vaccination of stranger adults and revaccination should be made compulsory. The fatality of each epidemic is influenced by the susceptibility of unprotected adults. Small-pox.

The mortality from measles is higher than in the year preceding by 149 deaths, and 96 above the average of the five previous years. The incidence follows the seasonal fluctuations observed in the periodical epidemics of small-pox; the highest number of deaths occurred in April and May, 90 and 119 in each month; in June the deaths fell to 76; in July to 50; in August to 22, and in September to 15. It is deserving of attention that the seasonal incidence of measles and small-pox follow the same course, and that in two years in which there was a very low mortality from small-pox, there was a comparatively high mortality from measles. Measles.

The year 1886 is memorable in the sanitary history of this city as the year of the smallest number of deaths yet registered from cholera in Bombay. In few years since 1848 has cholera not been epidemic; the only two years in which a mortality nearly as low as in 1886 has been observed have been 1874 and 1880; in 1874 only 20 deaths occurred, and in 1880 but 10 more than in 1874—30 in all in that year. So small a mortality as 19 from cholera is a very remarkable sanitary event for this city, and that event is still more remarkable through the occurrence of an equally low mortality from small-pox. In 1886 cholera may be considered not to have been epidemic in this city. It will be observed when the statistics have been published whether the mortality in this city has been synchronous with a low mortality in the country around. I have before pointed out that years of epidemic prevalence in the country around this city are generally years of epidemic activity in this city. Of the 32 attacked, 4 were born in Bombay and 28 elsewhere. 75 per cent. of those attacked born in Bombay died, and 57 per cent. of those born elsewhere. In reference to the incidence of cholera by place of birth I would refer to some observations in the last Annual Report. Cholera.

	Attacked.	Died.	Per cent.
Males -	- 27	14	51·85
Females -	- 5	5	100·00

Of those attacked 8 were under 3 months in the city and 5 were over 3 and under 6 months.

The sources of water supply are indicated in the statement following :—

	Attacked.	Died.
Vehar and Tulsi water -	- 26	17
Well water - - -	- 6	2

The 19 deaths were confined to 4 classes, 14 occurring amongst the large class of the Hindu population; 2 deaths occurred amongst Mussulmans, 1 amongst Brahmans, and 2 in the Parsee community. The lowest proportion of deaths to attacks, equal to 25 per cent., occurred in the Mussulman population. Amongst Europeans 1 case was reported, but not fatal. The mortality amongst Brahmans was below the average, being equal to 50 per cent.

In the mortality from fevers there is a remarkable reduction; 5,820 deaths were registered being 828 deaths less than in the previous year, and 434 less than the average mortality of the five years preceding. Of the deaths from fevers, 4,479 were referred to remittent fever, being 707 less than in the last year, and 362 less than the avereage of the five years preceding; 146 were referred to ague, being 135 less than Fevers.

in the last year, and 273 less than the average; 1,177 were referred to simple continued fever, being 6 more than in the last year, and 199 above the average; 18 were referred to enteric fever, being 8 more than in the last year, and the same number as in 1884, and 2 more than the average. The registration of different types of fever cannot be accepted as accurate; but, although this is so, the figures as a whole, indicate a large reduction of fever mortality. Before the registration of fever types can be more correct, it will be necessary to have a wider and more organised system of medical relief at the homes of the poor.

The mortality from diseases of the digestive system is 123 less than in 1885 and 286 less than the average of the last five years: of the deaths from diseases of the digestive system, 1,032 were referred to diarrhœa, being 95 more than in the last year, and 90 less than the average; 484 were referred to dysentery, being 124 less than in the last year, and 143 less than the average; in 1885 there was also a reduction of 27 deaths in the mortality from dysentery. To all other diseases of the digestive system, 500 deaths were ascribed, being 94 less than in the last year, and 53 less than the average.

From diseases of the respiratory system, 3,810 deaths were registered, being 23 more than in 1885 and 185 more than the average. Of the deaths from diseases of the respiratory system, 2,436 were referred to bronchitis, being 43 less than in the last year and 290 more than the average; 786 were referred to pneumonia, being 88 less than in the last year and 261 less than the average. With greater power for the treatment of unwholesome buildings there would be a great reduction in the mortality from diseases of the respiratory system, and especially among women.

The total number of births registered during the year was 14,909, or 19·28 per 1,000 of population. The male births (7,772) were 10 more, and the female births (7,137) 65 less than in the past year. In the last quarter there was an improvement in birth registration as indicated by the increasing number of births. The duties of the Karkoons have been most carefully supervised, and, so far as organization, I do not think practical improvement can be made. It is almost useless prosecuting, as it has been held by the chief police magistrate that the evidence of some person present at the birth is necessary; in other words, either the person professionally engaged at the birth or a relative of the person prosecuted. What we need is the assistance of the people—of neighbours to inform on neighbours, and this they are most reluctant to do.

(In consequence of a change in the *personnel* of the Army Sanitary Commission, no Memoranda by that body on the Indian Sanitary Reports for 1886 have been received.)

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REPORT

ON

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TOGETHER WITH

MISCELLANEOUS INFORMATION TO JUNE 1889.

Vol. XXI.

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CONTENTS.

REPORT.

	Page
I. European Army:	
Sickness and mortality in 1887	1
Cholera	2
Small-pox	3
Fevers	3
Bowel complaints	4
Venereal diseases	4
Invaliding	4
II. Native Army:	
Sickness and mortality in 1887	5
Bengal	5
Madras	7
Bombay	7
III. General Population:	
Mortality from chief diseases	8
Bengal	8
Madras	9
Bombay	10
Punjab	11
North-Western Provinces and Oudh	12
Central Provinces	13
Berar	14
Assam	14
Lower Burma	15
IV. Jails:	
Sickness and mortality in 1887	16
Bengal	16
Madras	17
Bombay	18
Punjab	18
North-Western Provinces and Oudh	19
Central Provinces	19
Berar	19
Assam	20
Lower Burma	20
V. Vaccination:	
General results	21
Bengal	21
Madras	21
Bombay	22
Punjab	22
North-Western Provinces and Oudh	22
Central Provinces	22
Berar	22
Assam	23
Lower Burma	23
VI. Medical Institutions:	
Civil Hospitals and Dispensaries:	
Bengal	24
Madras	25
Bombay	25
Punjab	26
North-Western Provinces and Oudh	26
Central Provinces	26
Berar	27
Assam	27
Lower Burma	27
Lock Hospitals:	
Bengal	28
Madras	28
Bombay	28
Punjab	29
North-Western Provinces and Oudh	29
Central Provinces	29
Lower Burma	29
Lunatic Asylums:	
Bengal	29
Madras	30
Bombay	30
Punjab	30
North-Western Provinces	31
Central Provinces	31
Assam	31
Lower Burma	32
Medical Schools:	
Bengal	32
Madras	32
Bombay	33
Punjab	33
North-Western Provinces and Oudh	34
VII. Sanitation:	
Civil:	
Bengal	35
Madras	35
Bombay	36
Punjab	36
North-Western Provinces and Oudh	37
Central Provinces	37
Berar	38
Assam	38
Lower Burma	38
Military:	
Bengal	38
Madras	38
Bombay	39

I 58939. Wt. 337.

ABSTRACTS.

India Sanitary Report for 1887:
- European troops - 43
- Native troops - 57
- Jails - 65
- General population - 74
- History of chief diseases - 77
- Vaccination - 90
- Sanitary works - 93
- General remarks - 97
- Memorandum on Cholera as a preventable disease - 99

Madras Sanitary Report for 1887:
- Vital statistics - 108
- Chief diseases - 110
- Sanitary works - 113
- General remarks - 115

Bombay Sanitary Report for 1887:
- Vital statistics - 118
- Chief diseases - 120
- Vaccination - 122
- Sanitary works - 124
- Personal Proceedings and General Remarks - 125

Calcutta Municipal Report for 1887 - 127
Calcutta Health Ditto - 142
Madras Municipal Ditto - 152
Bombay Municipal Ditto - 159
Bombay Health Ditto - 163

APPENDIX.

Despatch to Government of India and Memorandum by Colonel Sir Henry Yule on Indian Sanitary Administration - 173

INDIA OFFICE,
22nd August 1889.

J. A. GODLEY,
Under Secretary of State.

REPORT.

I.—EUROPEAN ARMY.

Sickness and mortality in 1887.

THE health of the European troops in India during 1887 was on the whole more satisfactory than in the previous year. Of an average strength, excluding troops on active service in Burma, of 63,514, the admissions into hospital were in the ratio of 1,370 per 1,000 against 1,514 in 1886, the daily sick rate 70 or 5 per 1,000 less, and the death-rate 14·20 against 15·18. Compared with the decennial average of 1870–79 the mortality in 1887 was 5·14 per 1,000 lower. The loss by invaliding was 23 per 1,000, or 2 per 1,000 in excess of the previous year, bringing the total loss by death and invaliding to 37 per 1,000 against 36 in 1886.

The proportions in which each of the Presidency Armies contributed to these results as compared with the previous year were as follows:—

Presidency.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total loss.
Bengal	1886	38,784	1,559	73	15·52	18	34
	1887	40,601	1,426	69	14·83	19	33
Madras	1886	11,181	1,380	82	16·46	24	40
	1887	11,725	1,250	77	12·96	31	44
Bombay	1886	11,050	1,490	73	12·67	28	41
	1887	11,188	1,292	67	13·23	28	41
INDIA	1886	61,015*	1,514	75	15·18	21	36
	1887	63,514*	1,370	70	14·20	23	37

* Excluding troops on active service in Burma.

In all three armies there was less sickness than in 1886, and the mortality was not so great except in the case of the Bombay Army, which recorded a death-rate slightly in excess of the previous year. The improvement in the Madras Army was the more satisfactory as in 1886 it returned the highest death-rate. In the Army as a whole malarial fevers, enteric fever, venereal disease, rheumatism and neuralgia, and diarrhœa contributed lower admission-rates than in 1886, but there was a considerable increase in the admissions from cholera, and the mortality from this disease rose from 0·49 to 2·0 per 1,000. Enteric fever continued to head the list of death causes, though the mortality declined from 5·08 per 1,000 in 1886 to 3·76.

In the Bengal Army there was less sickness in 1887 than in any year of the previous decade. Compared with 1886 the admission-rate fell from 1,559 per 1,000 to 1,426; there was also a fall in the death-rate from 15·52 in the previous year to 14·83, and this notwithstanding that cholera was more prevalent and fatal. Of the six geographical groups into which the Bengal Army is divided four returned a higher admission-rate than the average rate of the Presidency, viz., Meerut and Rohilkund group 1,750 per 1,000, Agra and Central India 1,696, Bengal Proper 1,617, and Gangetic Provinces and Oudh 1,437. All of these were below the ratios of 1886, the last, showing a decrease of about 200 per 1,000. In the remaining two groups the Punjab recorded an admission-rate of 1,375 per 1,000 and the Hill Stations 1,112, against 1,142 and 1,219 respectively in 1886. Only in the two groups of Agra and Central India and the Gangetic Provinces and Oudh was the mortality greater than the average rate of the Presidency; and in these, together with the Hill Stations group, it was in excess of the previous year. In the Agra and Central India group the rise in the death-rate from 15·91 in 1886 to 20·03, and in the Gangetic Provinces and

Oudh from 17·09 to 19·01 was due chiefly to cholera, the death-rate from that disease in the former group having risen from 1·18 to 5·46 per 1,000, and in the latter from 1·88 to 3·83. The increased death-rate in the Hill Stations from 10·27 to 12·42 was due chiefly to an outbreak of cholera at Ranikhet, and in a less degree to a greater mortality from enteric fever.

Among the troops serving in the districts of Rajputana, Malwa, Sind, and Aden (average strength 5,614) there was less sickness as compared with the previous year, the admissions having declined from 1,637 per 1,000 to 1,413, but the death-rate rose from 14·94 to 17·10 per 1,000. The increased mortality was chiefly due to cholera, from which there were 23 deaths, equal to 4·10 per 1,000, against only one death in 1886. On the other hand, the death-rate from enteric fever fell from 5·83 to 3·92 per 1,000. Of the 23 cholera deaths in this group 17 occurred at Neemuch, more than half its total mortality (30).

In the Deccan and Nagpur group the ratio of admissions per 1,000 of an average strength of 9,101 was 1,184 against 1,279 in 1886, and the death-rate 10·88 against 10·52. There were 10 deaths from cholera against none in the previous year, but enteric fever was less fatal, the ratio of mortality having declined from 4·49 to 3·73 per 1,000. The Poona garrison was the healthiest station of this group with a death-rate of 7·19 per 1,000, or 3·26 less than that of 1886. Secunderabad also returned a much lower death-rate than in the previous year, viz., 12·07 against 15·90 in 1886.

The Southern Indian group recorded a lower admission-rate with a slightly increased death-rate, the former having declined from 1,311 per 1,000 of average strength to 1,163, and the latter having risen from 10·68 to 11·36. The decrease in sickness was due to the diminished prevalence of fevers, dysentery, and diarrhœa, but chiefly to a fall in the admissions from venereal diseases from 483 to 401 per 1,000. At the large station of Bangalore in this group, with an average strength of 2,077, the admission-rate fell from 950 per 1,000 in 1886 to 799 in 1887, while the mortality increased from 7·53 to 9·15, owing principally to enteric fever, from which there were 11 deaths, or three more than in 1886.

Among the troops serving in the regular stations of Burma and Pegu there was considerably less sickness as compared with the previous year, and the mortality from climatic causes was exceptionally low. The admission-rate decreased from 1,905 to 1,468 per 1,000, and the death-rate from 34·73 to 11·61 per 1,000. With an average strength of 1,809 there were only 21 deaths, or 38 less than in 1886. At Rangoon, the largest station of this group, the ratio of mortality was 13·11 per 1,000 of an average strength of 915, against 39·74 in 1886.

There was less sickness among the troops in the Hill Stations of Madras and Bombay, but a slightly increased mortality as compared with the previous year, the admission-rate having declined from 1,800 per 1,000 in 1886 to 1,690 in 1887, and the death-rate having risen from 14·68 to 15·62 per 1,000 of an average strength in 1887 of 960. These stations were entirely free from enteric fever during the year, and there were far fewer admissions from fevers of remittent and continued type. Intermittent fever and venereal diseases were the chief causes of sickness; the admissions from the latter were in the ratio of 435·4 per 1,000. The increased mortality was due to hepatitis and abscess of liver.

Among the troops serving in Upper Burma (average strength 4,319) the admissions into hospital were in the proportion of 2,388 per 1,000 and the deaths 40·29 per 1,000. The chief causes of sickness were intermittent fever and venereal diseases, the former yielding a ratio of 1,012 and the latter of 406 per 1,000. Of the 174 deaths in this force at least 20 per cent., it is reported, was due to direct exposure and accident. The mortality was heavy compared with 14·20, the average ratio of the whole European Army of India; still it compares favourably with that of troops on active service in Afghanistan in 1878–80.

Cholera.

In the European Army of India, as a whole, there were 183 cases of cholera during 1887, and of these 127 were fatal. This is a great increase on 41 cases and 30 deaths in 1886. The disease prevailed very much among the troops of the Bengal Presidency, the deaths numbering 92 against 25 in the previous year, the proportion to average strength being 2·27 per 1,000 against 0·64. Cholera was widely distributed in the Bengal Army, each group of stations having been affected, and all, with the exception of Bengal Proper, having recorded deaths. More deaths (27) occured in the Punjab than in any other group, but the highest ratio of mortality (5·46) was returned by the Central India group. Notwithstanding this great increase in cholera mortality in the

Bengal Army, it is satisfactory to learn from Surgeon-Major Hutcheson's interesting Memorandum on Cholera as a Preventable Disease (*see* Abstract of Report of the Sanitary Commissioner with the Government of India, page 99), that there has been a great diminution in the death-rates in recent as compared with former years. The average mortality for the 15 years, 1858 to 1872, was 8·27 per 1,000 against 3·01; the ratio of the second period, from 1873 to 1887. He also shows that this marked decrease corresponds with an approximate diminution in the mortality from cholera among Native troops and prisoners confined in Bengal jails, the average annual death-rate among the former having declined from 2·57 to 1·34, and among the latter from 7·94 to 3·27 per 1,000. "That this lessening mortality is real," Surgeon-Major Hutcheson remarks, "and not a mere statement based on inaccurate statistics, and the "manipulation of figures, is proved by the gradual diminishing number of deaths year "by year from this cause in all the important stations of the Bengal Presidency, and "among communities regarding whom the vital statistics are as accurate as any other "community in the civilised world."

In the Madras Army there were only 7 deaths from cholera, and of these 4 occurred at Secunderabad, and 1 each at Kamptee, Bellary, and Thayetmyo in Lower Burma, which is included in the Madras Command. Among the troops of the Bombay Presidency there were 28 deaths from cholera, giving a ratio of 2·50 per 1,000 against 4 deaths, or 0·36 in 1886. Of the 28 deaths Neemuch contributed 17 and Mhow 5.

Small-pox.

In the whole European Army there were 39 cases of small-pox in 1887, 2 of which proved fatal. All the cases but one and both deaths took place in the Bengal Army, the remaining case having occurred in the Bombay Army. The Madras troops enjoyed a total immunity from the disease.

Fevers.

Intermittent fever was less prevalent among the European troops than usual, the admissions being in the ratio of 300 per 1,000 of average strength against 332 per 1,000 in 1886. It was, however, slightly more fatal, 7 deaths having occurred against 6 in the previous year. The decrease was confined to Bengal and Bombay, as in Madras the ratio of admissions remained all but stationary. Remittent and continued fevers were also less prevalent, as shown by the fall in the admission-rate from 113 to 91 per 1,000, and the deaths from 45 to 40. In all three presidencies the admission-rate was less, and likewise the mortality in Bengal and Madras.

The statistics regarding enteric fever were more satisfactory than in 1886. In the Army as a whole there were 806 admissions and 239 deaths, equal to 3·76 per 1,000 of strength against, 1,105 cases and 310 deaths or 5·08 per 1,000 in 1886. The improvement was spread over all three presidencies, but it was most marked in Bengal, where the death-rate fell from 5·70 to 4·09; in the Madras Army the mortality declined from 3·85 to 2·98 per 1,000; and in Bombay from 4·16 to 3·40. In each case, however, the ratio of mortality was higher than the decennial averages of 1870–79; "but prior to 1880," the Sanitary Commissioner with the Government of India (Sir B. Simpson) remarks, "enteric fever was undoubtedly very frequently "returned under other fevers, and the progressive increase of late years in the "admission and death ratios is simply due to greater accuracy in diagnosis. It is "satisfactory to note, however, that this progressive increase has received a decided "check in the year under review." The year's returns continued to bear evidence of the liability of youth and of troops of short service in India to this fever. Among men under 25 years of age the mortality ratio was 5·37 per 1,000 against 7·44 in 1886, while among those from 25 to 29 years of age it was 2·63 against 3·08; and among soldiers in their first and second year's residence in India the death-rate from enteric fever was 7·13 per 1,000 against 8·63 in 1886, and among those in their third and sixth year it was 2·37 against 3·31. Sir B. Simpson states: "The percentage of "liability to enteric fever during the first and second year's residence is greater "than the total of all the other periods. The high average mortality is shown to "be due to the large proportion of young men under 25 comprising the bulk of the "European Army of India and the short system of service which permits of an "excessive number of youths being passed into service in a sub-tropical climate at "a period of life when they are most susceptible to particular diseases, and especially "to enteric fever. The high average death-rate from enteric fever among the troops "in India compared with the death-rate from the same cause among troops serving "in the United Kingdom, points to specific and predisposing causes at work in India, "which do not obtain to the same, or nearly the same, extent in England. The

"average mortality from the disease among troops in India is about 10 times greater "than at home." He also states that "the cause, or the exciting or predisposing "causes of enteric fever, are no nearer elucidation than in former years, and the "views of medical officers regarding the nature and etiology of the disease have "undergone no definite change or modification."

Bowel complaints.

Dysentery and diarrhœa were both less prevalent in the European Army during 1887 than in the previous year, and the death-rate fell from 1·27 to 0·71 per 1,000. Dysentery, though more prevalent in the Madras Army than in the other presidencies, was considerably less fatal than in 1886, the ratio of mortality having declined from 2·77 to 0·85 per 1,000.

Venereal diseases.

The steady and progressive increase which had marked the admissions from venereal diseases in previous years received a check in 1887. In the Army as a whole the ratio per 1,000 of strength was 361 against 389 in 1886. The decrease, however, was confined to the Bengal and Bombay Presidencies, as in Madras there was a small increase of 6 per 1,000. In the Bengal Army the admission-rate for the year was 356 per 1,000 against 394 in 1886, in the Madras Army 400 against 394, and in the Bombay Army 337 against 370.

Invaliding

The loss to the whole Army by invaliding during 1887 amounted to 1,443 men, equal to 22·57 per 1,000 of strength, against 1,303 men, or 21·10 per 1,000 in 1886. The increase was spread over the three presidencies, but only to a very slight extent in Bengal and Bombay, while in Madras the ratio rose from 23·86 per 1,000 in 1886 to 30·79, the increase, in a great measure, being due to venereal diseases. The percentage of those invalided as unfit for further service was 37, or 4 per cent. less than in 1886. As regards the influence of age and length of residence in India upon invaliding, 49·41 per cent. of the number were under 25 years of age, against 43·92 in 1886, while 25·02 per cent. had been less than two years in India, and 52·88 per cent. had from 2 to 5 years' service. In the whole Army 73 per cent. of the men had not more than 5 years' Indian service, and 77·90 per cent. of the total number invalided had been less than five years in India.

II.—NATIVE ARMY

The health of the Native Army of India in 1887 was on the whole satisfactory. There was more sickness than in the previous year, but it was not of so severe a type, the death-rate being 1·59 per 1,000 below the ratio of 1886. Sickness and mortality in 1887.

The ratios of sickness and mortality of each section of the Native Army of India for 1887 and the previous year, are given in the following table:—

		Average Strength.	Ratio per 1,000 of Average Strength.			
			Admissions.	Daily Sick.	Deaths.	Total Deaths, including Absentees.
Bengal Native Army	1886	40,547	1,065	34	14·45	22·29
	1887	42,586	1,057	35	12·63	19·95
Madras ditto	1886	22,070	756	30	14·05	21·25
	1887	20,031	772	32	11·53	22·22
Bombay ditto	1886	21,089	1,231	37	15·98	20·89
	1887	20,353	1,092	34	11·50	15·45
Central India Regiments	1886	5,250	719	18	6·67	8·22
	1887	5,305	755	20	7·16	8·40
Punjab Frontier Field Force	1886	10,684	979	28	9·83	13·59
	1887	11,961	1,687	38	11·87	14·88
Hyderabad Contingent	1886	6,370	483	16	5·34	6·06
	1887	5,018	614	20	9·16	12·66
INDIA	1886	106,010*	973	31	13·27	19·46
	1887	105,254*	1,045	33	11·68	18·17

* Excluding men on active service in Burma.

It will be seen from the above statement that the Central India Irregular Force and the Hyderabad Contingent were, as usual, the healthiest branches of the Native Army, and that Bengal returned the highest death-rate followed by the Punjab Frontier Force, which also recorded the highest admission-rate.

The chief causes of sickness were, as usual, malarial and simple fevers, from which the admissions were in the proportion of 514 per 1,000, showing a considerable increase on 429, the ratio of 1886. There was also a slight rise in the admissions from dysentery and diarrhœa, with a decrease in the cases of respiratory diseases and neuralgia. Respiratory diseases were the chief death causes, followed by fevers, cholera, phthisis pulmonalis, dysentery, and diarrhœa. Of the total 1,229 deaths in the Army, respiratory diseases contributed 324 or 3·08 per 1,000 of strength, against 390 or 3·68 in 1886; and cholera 138 deaths, equal to 1·31 per 1,000, against 135 or 1·27 in 1886. Enteric fever was more prevalent, the deaths having increased from 5 in 1886 to 15 or 0·14 per 1,000 in 1887. The high mortality from respiratory diseases and the low death-rate from enteric fever are in marked contrast with 0·68 and 3·76, the corresponding ratios of the European troops.

The results of the Native Army of Bengal for 1887 were more satisfactory than those for the previous year, both admissions and mortality having given rise to smaller ratios. The admission-rate (1,057 per 1,000) was lower than in any year since 1877, except 1883, and the death-rate (12·63) was nearly 2 per 1,000 below that of 1886. Respiratory diseases were slightly less fatal, but still caused the highest proportion of mortality (3·19). There were 108 cholera cases under treatment during the year, and of these 64, or nearly 60 per cent., proved fatal. In the previous year there were 76 cholera deaths in the Bengal Native Army. Dysentery and diarrhœa were also less fatal, the deaths having decreased from 100 or 2·47 per 1,000 in 1886 to 63 or 1·49. Bengal Native Army.

The following statement gives the principal statistics of the regular troops in Bengal, arranged in geographical groups, for 1887 and the preceding year:—

		Average Strength	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1886	5,228	1,692	66	38·45
	1887	5,654	1,462	61	14·32
Gangetic Provinces	1886	5,980	896	28	5·35
	1887	5,970	906	30	7·54
Rohilkund and Meerut	1886	5,280	1,349	45	13·64
	1887	5,282	1,258	44	21·39
Agra and Central India	1886	3,480	1,386	35	6·90
	1887	3,826	1,220	42	8·36
Punjab	1886	18,473	779	25	8·61
	1887	20,436	894	25	10·33

Of these five groups, Bengal Proper and Assam continued to hold the first place as regards sickness, though the ratio showed a great improvement on that of the previous year. The two groups of Meerut and Rohilkund and Agra and Central India came next, but both with smaller ratios as compared with 1886. In the remaining groups there was a slight increase in sickness. Mortality was highest in Rohilkund and Meerut group, and the death-rate (21·39) was in excess of any year since 1880, and 7·75 per 1,000 above the ratio of 1886. The increase was due chiefly to cholera, remittent fever, and dysentery. In Lower Bengal and Assam the death-rate (14·32) was 24·13 per 1,000 below 1886, and was accounted for by the lessened mortality from cholera, fevers, and dysentery and diarrhœa. The 1886 statistics of this group were vitiated by the extreme unhealthiness of the troops stationed at Tammu. In the year under notice the death-rate at this station was 24·81 per 1,000 against 328·67 in 1886. Of individual stations in the Bengal Command eight recorded death-rates exceeding 20 per 1,000. Quetta district returned the highest, viz., 68·54 per 1,000, which, however, was 41·33 per 1,000 less than the ratio of 1886. Out of 44 deaths at this station 20 were from pneumonia.

Punjab Frontier Force.

The health statistics of the Punjab Frontier Force for 1887 compare very favourably with those for 1886. Of an average strength of 11,961 the admissions into hospital were in the proportion of 1,687 per 1,000 against 979, and the deaths 11·87 per 1,000 against 8·83. Nearly two-thirds of the admissions were from intermittent fevers, the ratio being 1,088 per 1,000 against 465 in 1886. As in other branches of the Native Army, respiratory diseases were the chief causes of death, but the increased mortality was mainly due to dysentery, diarrhœa, and cholera. Until 1887 this force had enjoyed a total immunity from cholera, but during the year under notice there were 34 cases with 19 deaths.

Central India Irregular Force.

The health of the Native troops composing the Central India Irregular Force (average strength 5,305) was generally good during 1887, though there was a slight rise in both sickness and mortality as compared with 1886, the admission-rate having risen from 719 to 755 per 1,000, and the death-rate from 6·67 to 7·16 per 1,000. The most fatal diseases in this force were fevers, pneumonia, and cholera. The increased mortality was more than accounted for by 4 deaths from cholera, as in the previous year there were no deaths from this disease.

Hyderabad Contingent.

Among the troops composing the Hyderabad Contingent the results were not so satisfactory as usual. Of an average strength of 5,018, the admission-rate was 614 per 1,000 and the death-rate 9·16 per 1,000 against 483 and 5·34 respectively in 1886. The chief death cause was cholera, from which there were 7 deaths against none in 1886. The exceptional rise was also attributed to the indirect influence of service in Upper Burma, one cavalry regiment which was on field service there having lost 10 men from all causes and two infantry regiments (3rd and 2nd) 14 and 12 men respectively.

Madras Native Army.

The health statistics of the Madras Native Army for 1887 do not compare favourably with those for the previous year, owing chiefly to the influence of active service in Upper Burma; the standard of health of regiments that returned thence having been reduced by exposure and climate. The ratio of admissions to hospital per 1,000 of an average strength of 20,031 was 772 against 756 in 1886, the daily sick rate was 32 or 2 per 1,000 more, and the death-rate 11·53 against 14·05. There was thus a considerably reduced mortality, but including the deaths of men absent from their regiments on sick leave and for other reasons the death-rate was slightly higher, viz., 22·22 per 1,000 against 21·25. Cholera was again the chief cause of death, and contributed a larger mortality than any other disease, though the deaths, numbering 30 or 1·49 per 1,000, were fewer by 26 than in the previous year. Of other diseases intermittent fevers came next in regard to mortality with a ratio of 1·40 per 1,000 against 0·27 in 1886, followed by respiratory diseases with a death-rate of 1·20. Of the larger stations in the Madras Command, Secunderabad continued to maintain its character for unhealthiness. Its admission-rate per 1,000 of an average strength of 3,045 was 1,084, and its death-rate 14·45, of which 4·93 per 1,000 was due to cholera. On the other hand Bangalore, with an average strength of 2,703, returned an admission-rate of only 584 per 1,000 and a death-rate of 12·21. None of the Madras stations recorded a mortality exceeding 20 per 1,000, and in five stations there were no deaths. Of the Burma stations included in the Madras Command, Toungoo, with an average strength of 437, had the highest mortality (27·46). Of the 12 deaths in this garrison 7 were from intermittent fever. At Rangoon the death-rate from all causes was 24·26, nearly half being due to intermittent fever.

Bombay Native Army.

The Bombay Native Army enjoyed much better health in 1887 than in the previous year. Of an average strength of 20,353 the admissions to hospital were in the proportion of 1,092 per 1,000 against 1,231 in 1886, the daily sick rate 34 or 3 per 1,000 less, and the death-rate 11·50 against 15·98, or including absent deaths 15·45 against 20·89. Cholera was slightly more prevalent, the deaths having risen from 3 to 14, but there were fewer deaths from fevers, respiratory diseases, and dysentery. Of individual stations in this Command, Quetta (average strength 3,589) was the most unhealthy, recording an admission-rate of 1,977 per 1,000 and a death-rate of 27·03. This, however, is a great improvement on 2,444 and 45·73, the corresponding ratios of the previous year. More than 50 per cent. of the deaths among Bombay troops at Quetta resulted from respiratory diseases. Sir B. Simpson advises that "troops in "that district should be carefully hutted in cold weather; and reliefs, which ordinarily "take place during the winter months throughout India, should be regulated in the "Quetta district according to the season which is less likely to affect the troops "injuriously from extreme cold and exposure in the open, or in tents." Poona, with an average strength of 2,409, recorded the low death-rate of 6·64 per 1,000; and Aden, with an average strength of 1,015, of 9·85.

III.—GENERAL POPULATION.*

Births were registered throughout all the provinces of India in 1887 excepting Lower Bengal, where the system of limited registration was still in force, and during the year was confined to 100 towns. Among the nine principal provinces the birth-rate exceeded 40 per 1,000 in Berar and the Central Provinces; it was over 38 per 1,000 in the Punjab, North-Western Provinces and Oudh, and Bombay Presidency; and in the remaining four provinces, it varied between 19·35 in Bengal to 31·0 in Madras Presidency. In seven of the nine provinces the birth-rate exceeded the death-rate; the exceptional cases being Bengal, where the mortality was 4·98 per 1,000 greater than the births, and in Berar, where the death-rate was 4·8 per 1,000 above the birth-rate. The registered deaths numbered 5,508,453 or 28·35 per 1,000 of population under registration, being 3 per 1,000 higher than the ratio of 1886. By provinces the death-rate ranged between 45·33 per 1,000 in Berar to 16·18 in Lower Burma, and 21·67 in Madras Presidency. Of the chief diseases, cholera accounted for a much higher mortality than in 1886, the deaths having risen from 209,150 or 1·05 per 1,000 to 475,675 or 2·40. The disease was especially severe in Berar and the North-Western Provinces and Oudh, the former having recorded a cholera death-rate of 5·5 per 1,000, and the latter of 4·54. Small-pox also was more fatal than in the previous year and gave rise to the highest mortality in the Punjab, but in none of the nine provinces did the death-rate reach 1 per 1,000. From fever there were 110,080 more deaths, and from bowel complaints 25,988, than in 1886.

The deaths from the chief diseases and from all causes in the several provinces were as follows:—

	Cholera.		Small-pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1887.	1886.
Bengal, excluding Calcutta	172,578	2·60	3,846	0·05	1,087,768	16·44	56,898	0·85	1,552,528	23·46	21·99
Calcutta	1,198	2·76	2	—	3,253	7·50	1,197	2·76	10,979	25·34	26·42
Madras	28,359	1·01	21,472	0·76	240,860	8·63	26,679	0·97	604,775	21·67	19·72
Bombay	25,711	1·56	3,753	0·23	308,722	18·76	42,634	2·59	455,261	27·67	23·17
Punjab	8,804	0·47	16,382	0·87	447,994	23·78	24,538	1·30	646,384	34·31	26·60
North-Western Provinces and Oudh	200,628	4·54	8,492	0·19	1,136,496	25·76	70,145	1·59	1,581,739	35·86	33·27
Central Provinces	12,576	1·43	3,368	0·38	169,326	19·20	26,057	2·95	288,325	32·70	33·24
Berar	14,396	5·49	·811	0·19	48,114	18·36	21,530	8·21	118,797	45·33	36·70
Assam	7,941	1·75	1,162	0·26	65,105	14·38	13,912	3·07	111,015	24·52	45·33
Lower Burma	2,649	0·73	228	0·06	31,825	8·71	2,424	0·66	59,115	16·18	15·54
Mysore	332	0·20	6,608	1·61	42,668	10·43	5,458	1·33	76,074	18·59	17·18
Coorg	3	—	133	0·74	2,745	15·40	278	1·55	3,461	19·41	20·33
Total	475,675	2·40	65,757	0·33	3,584,876	18·12	291,745	1·47	5,508,453	28·35	25·34

Bengal.

During 1887, the registration of births was revived in a number of towns, the total number being 100 as against 45 in 1886. The result, however, was not at all satisfactory, as the birth-rate fell from 21·04 per 1,000 of population to 19·35, while the average rate was made up of ratios ranging from 50·21 per 1,000 in Jamalpore to 0·66 in Jehanabad. Registration of deaths showed an improvement compared with the previous year, the recorded number having risen from 1,455,305 or 21·99 per 1,000 in 1886 to 1,522,528, or 23·46 in 1887. The increase, however, was looked upon as more apparent than real, for Dr. Lidderdale, the Sanitary Commissioner, points out that the death-rate is calculated on the census of 1881, and that allowing for the probable increase in population since then the corrected death-rate for 1887 would be about 21·41 per 1,000. As usual, the district rates showed great variations, ranging from 35·31 in Monghyr to 12·53 per 1,000 in Mozufferpore. In the case of

Monghyr the apparently high death-rate was not due to its being an unhealthy district, but to the effective way in which registration was enforced by the Magistrate and District Superintendent of Police. In many cases the recorded results were so worthless as to necessitate the Local Government to bring the matter to the attention of the district authorities, and to urge them to take a personal interest in the work.

The mortality from cholera was unusually high, and the deaths rose from 148,368 or 1·78 per 1,000 in 1886 to 172,578 or 2·60 in 1887. The severity of the disease varied greatly in different parts of the province. The incidence was greatest in Behar division, which contributed nearly half (84,530) of the deaths, the districts most affected being Gya, Chumparun, and Shahabad. But the highest district death-rate was 9·75 per 1,000 at Puri, Gya coming next with a ratio of 8·05, Chumparun with 7·50, and Shahabad with 7·15. These towns were found to be greatly in need of sanitary improvement. Dr. Lidderdale reports that peculiar atmospheric conditions were associated with the appearance of the epidemic, "such as absence of the usual "west winds, replaced by damp winds from the east, and a heavy downpour of rain in "the end of May." The number of villages attacked with cholera, was 23,894, or 10·30 per cent. of the whole number, being an increase of 0·97 per cent. on the number of 1886. Cholera prevailed but slightly at the fairs during the year; the great majority entirely escaped. Pilgrims generally suffered very little from the disease, except in the Gya, Puri, Balasore, Cuttack, and Midnapore districts. In the lodging-houses in Gya, there were 197 cholera deaths, and 171 during the Car festival at Puri, besides a considerable mortality in Puri on the various roads to Juggernauth, and in the Midnapore district during the return from the car festival in July. Several sanitary improvements were recommended as being necessary at the principal halting places in the pilgrim route along the Puri and the Grand Trunk Road.

From small-pox, fewer deaths were registered than in any year on record. "A "death-rate per 1,000 of population of 0·05," the Sanitary Commissioner observes, "and a percentage of villages attacked of 0·90 are subjects of congratulation, and "evince the results following on the prosecution of vaccination in a systematic "manner." Of the total mortality (3,846 deaths), the Patna division, where vaccination has been extended to only three districts, contributed nearly half (47 per cent.); and the Orissa division, where vaccination is backward and inoculation active, 32 per cent. Many of the deaths reported as from this disease were, however, on inquiry found to have been due to measles and fevers.

The deaths from fevers amounted to 1,087,768, or 16·44 per 1,000 against 1,057,296, or 15·97 in 1886. The increase was attributed to improved registration, the year not being regarded as an unhealthy one. In 17 districts where fevers prevailed most severely, the death-rate ranged from 30·73 to 19·07 per 1,000, and of these, seven, viz., Rajshahye, Dinagepore, Julpaiguri, Maldah, Rangpur, Bogra, and Pubna, Dr. Lidderdale believes to be among the most feverish in the province, and he considers that this proves that in some parts of the country registration of deaths is beginning to show some relation to actual facts.

Under bowel complaints, 56,893 deaths were registered, equal to 0·85 per 1,000 of population, being an excess of 1,200 on the mortality of the previous year. "It is a curious circumstance," Dr. Lidderdale remarks, "how with advancing registration the "record under this head shows no improvement."

In Calcutta the year 1887 was the healthiest on record, the mortality being only 10,979, or 25·34 per 1,000 against 11,447 or 26·42 in 1886. "This low ratio," the Sanitary Commissioner with the Government of India states, "is probably due to the "fact that the majority of working men and traders who carry on business in Calcutta "are outsiders, and either lodge beyond the town limits or leave the town when "sick." Deaths from cholera were fewer than in any year since 1880, and in 1887 numbered 1,198, or 2·76 per 1,000 against 1,741 or 4·01 in 1886. The results of an investigation by the Health Officer in 1,866 cases of cholera showed that over 70 per cent. of the mortality was among the poorer population living in tiled huts. The year was also marked by a further fall in the death-rate from fever, viz., from 7·94 to 7·50 per 1,000.

Madras.

Each year witnesses a steady improvement in the registration of births in the Madras Presidency. During 1887 there were 867,451 births recorded, being in the ratio of 31·0 per 1,000 of population, which was the highest birth-rate on record since 1869, and 12,417 or 0·6 per 1,000 in excess of 1886. By districts the Nilgiris returned the lowest birth-rate (17·8) and Chingleput the highest (42·5). The assumed standard, however, of above 40 per 1,000 was attained only in four districts, in nine the birth-

rate was between 30 and 40 per 1,000, and in seven under 30 per 1,000. The registered deaths amounted to 604,775 or 21·6 per 1,000, being 50,848 or 2 per 1,000 more than the previous year's mortality. Thus, the births exceeded the deaths by 9·4 per 1,000, to which all the districts contributed except Ganjam, where the deaths exceeded the births by 2·9 per 1,000. The increased mortality was due chiefly to cholera, small-pox, and fevers, and partly to improved registration. As usual infantile mortality was very high, no less than 37·5 per cent. of the deaths having occurred among children under 5 years of age. In the district of Madras City more than half of the children born during the year died before they were a year old.

Of the chief diseases, cholera was fatal in 15,942 more cases than in 1886, the total deaths numbering 28,359 or 1·01 per 1,000 against 12,417 or 0·4. The disease was present during every month of the year, December being the most fatal month, when nearly half the deaths (13,626) occurred. Of the 21 districts in the Presidency Trichinopoly was the greatest sufferer, recording a death-rate of 3·6 per 1,000; Cuddapah followed with 2·9, Godavari with 2·01, and Tanjore with 1·6. It is noticeable that in the previous year the mortality for the most part was confined to Godavari and Kistna; in 1887 it was largely prevalent in the ceded districts and in the south. The Sanitary Commissioner (Surgeon-Major Laing) reports that satisfactory measures were taken by the district authorities to prevent the spread of the disease. "The laws which "govern the epidemic visitation of cholera," he says, "are so imperfectly known that "it would be useless to speculate as to why the disease increased in severity in 1887. "We, however, know that for the permanent avoidance of epidemic disease, cleanliness "is the sole safeguard, and that the chain of evil is abruptly broken wherever thorough "cleanliness prevails."

From small-pox there were 21,472 deaths, being in the ratio of 0·76 per 1,000 of population, against 17,129 or 0·6 in 1886. The disease was present in all the districts, but it was most fatal in Nilgiris and North Arcot, which recorded death-rates of 2·0 and 1·7 respectively. Of the total deaths 4,239 or 19·7 per cent. occurred among children under one year of age, and 8,619 or 40·1 per cent. among children between one and 12 years.

Fever deaths numbered 240,860 or 8·63 per 1,000 against 221,679 or 7·9 in 1886. The increase was confined to 15 districts, the remainder having recorded a lower mortality than in 1886. Kurnool, Ganjam, and Cuddapah headed the list of districts with death-rates of 23·4, 19·0, and 16·8 respectively, against 16·9, 11·0, and 13·7 in 1886. The figures under this head, however, are not very trustworthy, for Surgeon-Major Laing remarks that, "as most of the deaths are reported through curnams "(men who, as a rule, are illiterate and have no spark of medical knowledge), they "are inclined to ascribe to fever all deaths which do not result from easily recognised "causes." He also notices that the fever death-rate of the rural population (8·8 per 1,000) exceeded that of the municipalities (6·3) by 2½ per 1,000. "This fact," he says, "points to the necessity for improving village sanitation. There is no doubt "that much of the mortality attendant on fevers is due also to the habits of the "people themselves, and it is to be feared that until their habits are materially "changed, there will each year be a number of deaths from the various fevers which "prevail at different seasons throughout the Presidency."

Bowel complaints were responsible for 26,679 deaths against 27,379 in 1886, the ratio, 0·97 per 1,000, being the same in both years. Seven districts recorded lower death-rates than in 1886, in three the ratios were about the same, and in 11 higher. Madras City again returned the highest mortality of 7·3 per 1,000, and Chingleput followed with a ratio of 4·0.

Bombay.

In the Bombay Presidency the number of births registered has been regularly increasing since 1878, until in 1887 they reached 628,193, representing a birth-rate of 38·18 per 1,000 of population, a higher number than in 1886 by 46,640, or nearly 3 per 1,000. In some districts, however, registration was still very defective, especially in Bombay City and some of the Sind districts, but only in five districts was the birth-rate below 31 per 1,000. The year 1887 was an unhealthy one, and there was increased mortality from all the chief diseases. The total number of deaths registered rose from 381,185 or 23·17 per 1,000 in 1886 to 455,261 or 27·67. Registration of deaths continued to be more imperfect than of births, the defect being most marked in Ratnagiri and the five Sind districts. The district death-rates ranged from 11·86 in Upper Sind Frontier to 39·50 per 1,000 in Broach.

Cholera was remarkably quiescent in the previous year, but very virulent in 1887, the deaths having increased from 167 or 0·01 per 1,000 to 25,711 or 1·56. The Presidency was almost free from the disease until April, when there were signs of

epidemic intensity, and it reached its maximum in July, when 6,882 persons died. Of the 23 districts in the Presidency, Hyderabad, Thar and Parkar, and Upper Sind Frontier were unaffected, while the ravages of the disease were most severely felt in the Deccan, and especially in the districts of Satara, Sholapur, and Ahmednagar. Surgeon-Major Hewlett, Sanitary Commissioner, in his report for 1887 gives a table showing the cholera mortality for months during the 21 years ending 1886. It appears that the disease exhibits least intensity in December, increases slightly in January and February, commences in March and April to show marked development, increases by rapid strides in May and June, attains its maximum mortality in July, shows a decided fall in August, and gradually subsides in the following months until it reaches its minimum intensity in December. There also appears to be a lessened intensity of cholera every second or third year, while the cycle of minimum intensity is not reached until the sixth year. Ten per cent. of the total 24,535 villages recorded deaths from cholera. In the City of Bombay 262 cholera deaths were returned against 17 in 1886.

The number of deaths recorded as due to small-pox during the year was 3,753, or 0·23 per 1,000, being an increase of 2,877 on the number of 1886. Of these, 29·48 per cent. occurred among infants and 60·96 per cent. among children over 1 and under 12 years of age. Three districts were exempt from the disease, and four recorded only 2 deaths each. On the other hand, the disease was very prevalent in Khandesh, where more than two-thirds (2,678) of the total deaths took place.

Fevers, as usual, occasioned a very high mortality, more than two-thirds of the total deaths of the year having been recorded under this head. The deaths amounted to 308,722, or 18·76 per 1,000, an increase of 27,272 or 1·66 per 1,000 on the previous year. Broach continued to figure as the most fever-stricken district of the whole Presidency, recording the very high death-rate of 33·39 against 26·08 in 1886. Nine other districts had fever death-rates of over 20 per 1,000, varying from 21·58 to 27·12.

Under bowel complaints 42,634 deaths were recorded, being in the ratio of 2·59 per 1,000 against 36,612 or 2·23 in 1886. The principal sufferers were Belgaum, Dharwar, and Khandesh, which recorded death-rates under this head of 6·73, 5·86, and 5·34 respectively.

The year 1887 in the Punjab was very unhealthy, especially during the autumn months. Fewer births were registered than in the previous year, the number having declined from 743,739 or 39·47 per 1,000 of population to 732,648 or 38·88. The district ratios ranged from 12·41 in Simla to 51·71 in Sialkhot; but omitting Simla, where the proportion of male to female population is very great, and also the two frontier districts of Peshawar and Dera Ghazi Khan, where registration is specially defective; the next lowest birth-rate was 24·69 in Kohat. The mortality of the province during 1887 was much greater than in either of the two previous years. Altogether 646,384 deaths were recorded, which gives a ratio of 34·31 per 1,000 against 26·60 in 1886 and 26·92 in 1885. In all the seven districts of the Delhi division and in the districts of Peshawar and Kohat the deaths exceeded the births, but in the province as a whole there were 86,264 or 4·57 per 1,000 more births registered than deaths. The excess of deaths over births in the Delhi division was attributed mainly to fevers during the autumn months, and in Peshawar and Kohat to defective registration. As in the previous year the most unhealthy districts were Karnal, Delhi, and Gurgaon, the first recording a ratio of 51·21 and the other two of over 62 per 1,000 each. Every district recorded a higher death-rate than in 1886. The average death-rate of 49 principal municipal towns was 46 per 1,000 or 7 per 1,000 in excess of the birth-rate, and 12 per 1,000 higher than the provincial death-rate; it was also 12 per 1,000 higher than the rural death-rate. "This startling "result shows," the Sanitary Commissioner (Surgeon-Major A. Stephen) remarks, "how much has still to be done for the sanitation of the large towns. Village "sanitation is of the most rudimentary description, and yet, because villagers are out "in the open air for a considerable portion of the day, and their houses necessarily "better ventilated than the close alleys of our large towns, their death-rate is as "much as 12·05 per 1,000 less than that of the inhabitants of large towns."

Cholera was much more prevalent than in 1886, and there were more deaths recorded than in any year since 1869, except 1879. The deaths from this cause in 1887 numbered 8,804 or 0·47 per 1,000 of population against only 12 deaths in 1886. Of these, 6,582 took place in the months of August and September. Though deaths were recorded in 25 out of the 31 districts only 2·8 per cent. of the villages were affected. The greatest mortality occurred in the districts of Kohat (5·21 per 1,000), Bannu (2·79), Lahore (2·20), Hazara (1·25), Peshawar (1·24), and Karnal (1·09).

The mortality from small-pox was high, as many as 16,382 deaths having occurred in 1887, being in the ratio of 0·87 per 1,000, against 10,770 or 0·57 in 1886. Children under 1 year of age contributed 4,034 of the deaths, and children between 1 and 12 years old 10,884. The districts of Peshawar, Kohat, Bannu, and Dera Ismael Khan again recorded the largest number of deaths, and it was thought probable that the practice of inoculation which was prevalent in them was a principal cause of the propogation of the disease. The inoculators of some districts are reported to have refused to learn the art of vaccination, and the Civil Surgeon of Kohat stated that in his district the inoculators generally belong to the "Syad" caste, and when performing inoculations mutter incantations, which the parents believe will save their children from all misfortune ever after. The people accordingly have much respect and reverence for the inoculators, and the Civil Surgeon believes that they would not give up inoculation to practice vaccination unless they were paid four times as much as the Government vaccinators are.

No less than 447,994 of the total 646,384 deaths of the year were attributed to fevers, giving a ratio of 23·78 per 1,000 of population against 336,263 or 17·85 in 1886. This increased mortality was attributed to the heavy rainfall in the months of August and September, which had the effect of producing a water-logged subsoil in many districts. The average rainfall during the months of July, August, and September was 19·4 inches against 15·8 inches in the corresponding months of the previous year; and while during the months of September, October, and November in 1886 the deaths numbered 96,041; in 1887 there were nearly double as many, viz., 184,659. As in the previous year the mortality was greatest in the districts of Gurgaon, Delhi, Karnal, Umballa, and Rohtak. It is reported that the local authorities of the first of these districts contemplated taking measures to ameliorate the drainage of the worst locality, and that the case of the other districts would be considered in connexion with the general subject of village sanitation which had been pressed upon the Local Government by the Government of India; and in preparation for any measures which might be contemplated the Sanitary Commissioner had been asked to furnish a report on the effect on the public health of the realignment of the Western Jumna Canal, and of such drainage works in its vicinity as might have been completed for a sufficiently long time to admit of an opinion being formed as to their sanitary effects.

The mortality from bowel complaints was considerably above the average. During 1887 the deaths recorded under this head amounted to 24,538 or 6,712 more than in 1886, the death-rate being 1·30 per 1,000 against 0·95. As usual, the months of greatest mortality were September and October, when as many as 32 per cent. of the deaths occurred.

Progress continued to be made in the registration of vital statistics in the North-Western Provinces and Oudh. The total of recorded births during 1887 was 1,708,735 or 38·74 per 1,000, being an increase on the number of the preceding year of 49,203 or 1·12 per 1,000. The year under notice was a very unhealthy one in the provinces, and the number of persons reported to have died was 1,581,739, equal to 35·86 per 1,000 of the population, against 1,467,613 or 33·27 in 1886. The rate of mortality fell short of the birth-rate by only 2·88 per 1,000, while in 1886 the excess of births over deaths was equal to 9·4 per 1,000. Of the total deaths no less than 678,186 were of children under five years of age; the death-rate of infants under one year was 316 per 1,000. Of the 49 districts in the provinces, 19 recorded more deaths than births, and in three of them the excess ranged between 21 and 25 per 1,000. In one of these latter, the unhealthy district of the Tarai pergunnahs, the death-rate (56·89) was not particularly abnormal, the mean of the previous five years being 51·63; while in the other two, Jalaun and Jhansi, the death-rate stood at 66·18 and 71·59 per 1,000, against averages of 34·95 and 36·95. Cholera alone accounted for 17·9 of the death-rate in Jhansi, and 15·8 in Jalaun; but fever was their chief death cause as it was also of 15 other districts which recorded death-rates ranging between 40·46 and 57·07. Some of the towns also recorded very high death-rates, in 20 out of a total of 106 the mortality ranged between 50·22 and 85·43 per 1,000.

Cholera was more prevalent and fatal in 1887 than in any year on record, and accounted for 200,628 deaths, equal to 4·54 per 1,000 of population, against 34,565 or 0·78 in 1886. During the earlier months of the year the disease was confined to a few districts only, but it gradually spread over the whole provinces until not a district was free. The districts which suffered most were Jhansi, Jalaun, Rae Bareli, and Bara Banka. Out of a total of 105,421 villages, 18,205 were invaded by the disease.

The prevalence of the disease was at a minimum in January, and attained its maximum in June. This is characteristic of the seasonal prevalence of cholera in these provinces, as the Sanitary Commissioner shows by the mortality recorded during the last eighteen years. It also appears that high mortality is coincident with high temperature.

As in the two previous years, the province was remarkably free from small-pox in 1887, only 8,492 deaths having been recorded, equal to 0·19 per 1,000 of population, against 10,486 or 0·24 in 1886. Of these, 7,431 occurred among children under 12 years of age. The only districts in which the disease prevailed with any severity were Jhansi, Lalitpur, and Kheri, which recorded death-rates of 6·9, 4·8, and 1·1 per 1,000 respectively. These three districts contributed more than a half of the deaths from this cause.

Fevers were somewhat less fatal than in 1886, the deaths having declined from 1,216,618 or 27·58 per 1,000, to 1,136,496 or 25·76. Only in 10 districts of the 49 was the mortality below 20 per 1,000, and in the remainder the ratios varied between 20 and 49 per 1,000. Excluding the Tarai, with its fever death-rate of 49·47, "which "the nature of the country makes permanently pre-eminent as a fever locality," Meerut recorded the next highest death-rate (42·88), and 10 others recorded ratios over 30 per 1,000. "The number of deaths directly caused by fever," Dr. Richardson says, "although enormous, gives an altogether inadequate idea of its ruinous effects. "For every person who dies as the direct consequence of it, numbers are reduced by "it to a condition of helpless misery. Judged of either by the mortality it causes, "or by the prolonged suffering and abject poverty to which it gives rise, fever in "these provinces excels in importance all the other diseases combined."

Bowel complaints accounted for 70,145 deaths, equal to 1·59 per 1,000, as compared with the ratio of 1·34 in 1886. As usual, the districts of Hamirpur, Garhwal, Lalitpur, Dera Dun, Jhansi, Jalaun, and Kumaun suffered most, their death-rates ranging between 13·01 and 4·98 per 1,000.

The vital statistics of th[redacted]ral Provinces for 1887 indicate a further improvement in registration. The [redacted]r of births registered during the year amounted to 354,501 or 40·20 per 1,000, b[redacted]21,331 or 2·41 per 1,000 more than in 1886. The increase was confined to 13 out of the 20 registration districts; in four others the number of births was practically the same, while three showed a decrease. The birth-rate exceeded the death-rate by 7·50 per 1,000. Fewer deaths were registered in 1887 than in the previous year, the number having declined from 293,109 or 33·24 per 1,000 to 288,325 or 32·70. This was considered satisfactory as the rainfall of the year was abnormally heavy, and the poorer classes suffered from the continued pressure of high prices, and in some districts from insufficiency of food, tending to produce a low condition of health among them. Twelve districts recorded a lower mortality than in 1886. The highest district death-rate was 46 per 1,000, which was returned by Damoh, where also there was a heavy decrease (5·48 per 1,000) in the birth-rate. Over a third of the total deaths occurred among children under five years of age.

Though cholera was more widespread than in 1886, only four districts escaping in 1887, as compared with eleven in the previous year, the mortality was not so great. The total deaths from the disease amounted to 12,576 or 1·43 per 1,000 against 16,679 or 1·89 in 1886. Cholera was specially severe in Sambalpur, Narsingpur, Wardha, and Damoh, which recorded death-rates of 9·27, 7·27, 4·56, and 4·08 respectively, and these four districts recorded nearly three-fourths of the total deaths. The disease was present in every month of the year, but it did not establish itself in the province until May; it increased in violence in the monsoon months; after September it abated rapidly, and had almost entirely disappeared by the end of November. July was the most fatal month when 3,087 deaths were reported.

Small-pox was somewhat more fatal in 1887 than in the previous year, the deaths having increased from 2,774 or 0·31 per 1,000 to 3,368 or 0·38. Little reliance can, however, be placed in these figures, as in some places the deaths reported as due to this disease were found to have resulted from measles complicated with chest affections. The Chief Commissioner of the province has since directed the attention of certain authorities to the matter with a view to steps being taken to secure a more correct return of deaths under this head.

Fevers prevailed with less severity than in 1886. The deaths numbered 169,326 or 19·20 per 1,000, against 176,429 or 20·01 in 1886. It was again reported that a considerable number of deaths recorded as from fevers should have found a place elsewhere. The subject was inquired into more or less in most districts, and it would appear, it is

stated, that there is good reason for supposing that a considerable number of the deaths returned by the police as due to fever were in reality due to some form of bowel complaint or chest disease.

The deaths recorded from bowel complaints amounted to 26,057 or 2·95 per 1,000 against 25,708 or 2·92 in 1886. Sambalpur continued to head the list of districts with a death-rate from this cause of 12·34 against 11·45 per 1,000 in 1886. An investigation into the cause of this excessive mortality in Sambalpur was recently made, and the results go to prove that it was largely due to the use of bad drinking water by the people who are backward in their habits, and do not appreciate the advantages of good water or sanitary conveniences. Measures to improve this state of things are being taken by the Local Government, and it is hoped that in course of time they will result in a diminution of mortality.

Further progress was made in the registration of vital statistics in Berar during 1887. Dr. Little, the Sanitary Commissioner says: "I am of opinion that a very "considerable approach to accuracy has been obtained, and that our vital statistics as "regards numbers are not far removed from the truth, and may be accepted as fairly "representing the birth and death-rates of the province." In the year under review, 106,147 births were registered, yielding a ratio of 40·5 per 1,000 of population against 98,229 or 37·3 in 1886. Urban as compared with rural registration was reported to be still somewhat defective, but the town birth-rate (39·3) was gradually approaching that of the rural circles (40·6). The year was unhealthy, and all the principal diseases contributed in a larger proportion to the mortality than in 1886. The total deaths numbered 118,797 or 45·33 per 1,000, against 96,546 or 36·70 in the previous year. In all the seven districts there was an increased mortality, and five districts recorded more deaths than births. For the whole province, the average excess of deaths over registered births was nearly 5 per 1,000.

The increase in the year's mortality was chiefly due to cholera from which the deaths rose from 976 or 0·37 per 1,000 in 1886 to 14,396 or 5·49. The disease commenced in April, but did not spread as an epidem[redacted] June, when, favoured by the south-west monsoon, it developed greater activit[redacted] by July every district was affected. It attained its maximum in August [redacted] 7,277 deaths occurred; in September the deaths fell to about a half of this number, and during the following months they gradually decreased to 46 in December. Of the six districts, Amraoti and Buldana suffered most, their death-rates reaching 6·9 and 7·8 per 1,000 respectively, and Ellichpur least, with a ratio of 0·9. Out of 5,546 villages, nearly 20 per cent. recorded cholera deaths. Dr. Little believed that everywhere the outbreaks were of indigenous origin.

Small-pox contributed 311 deaths to the year's mortality against 116 in 1886, and of these 37·9 per cent. were of infants under one year of age, and 50·8 per cent. were of children between one and under twelve years. Small-pox is stated to have a tendency to recur with more or less epidemic intensity in the province in cyclical periods of five years; and to have started in 1887 on a fresh epidemic career, though milder in form than in 1882, and much more so than in 1877 and 1872, "which shows "that vaccination is slowly but surely producing its beneficial results and bids fair to "reduce the visitation in course of time to moderate proportions."

Deaths attributed to fevers amounted to 48,114 or 18·36 per 1,000 of population, being 2,471 in excess of those in 1886. At the instance of the Army Sanitary Commission all the Civil Surgeons in the province were called upon to report on the nature of the fevers met with in their several districts, and the results showed that the cause of death was ignorantly attributed to fever in a large majority of cases when the deaths really occurred from other causes, and that for the most part fevers in Berar were of malarious origin, due to climatic or telluric influences. "My own experience" Dr. Little remarks, "is that the fever of the plains is, as a rule, simple ague without "complications, and that chill and insufficient clothing are great factors in its pro-"duction. The complication in severe cases is pneumonia, which I believe to be the "cause of much of the mortality." Wun suffered more than any other district from fevers, recording a mortality of 25·7 per 1,000, and Basim the least, with a ratio of 11·3.

The deaths registered under bowel complaints numbered 21,530 or 8·21 per 1,000 against 16,791 or 6·38 in 1886. Ellichpur and Akola districts were again conspicuous for their high death-rates under this head, viz., 13·04 and 10·1 respectively.

The vital statistics of the area under registration in Assam for 1887 show an improvement on those for the previous year. The total number of births registered rose from 124,743 or 27·55 per 1,000 to 129,449 or 28·59, and the registered deaths

fell from 125,726 or 27·77 per 1,000 to 111,015 or 24·52. The improvement in the births, however, was confined to the Surma Valley and the Khasi Hills as in the Brahmaputra valley, there was a fall in the birth-rate. On the other hand there was a diminished mortality in every district of the province. Among the coolies in the tea plantations the births were in the ratio of 28·09 and the deaths 36·44 per 1,000.

To a great extent the improvement in the public health was due to the diminished prevalence of cholera, from which there were 7,941 deaths or 1·75 per 1,000, against 20,188 or 4·47 in 1886. All the districts except Cachar and Khasi Hills shared in the decrease, in these, however, the increase was very insignificant as compared with the fall in the plains districts of the Assam Valley proper.

Small-pox was considerably more fatal than in the preceding year, though the mortality was still much below the quinquennial average. The deaths amounted to 1,162 or 0·26 per 1,000 against 564 or 0·12 in 1886. Of these 81 per cent. were of children under 12 years of age. Little reliance can, however, be placed in these figures, as in two or three districts there was a very general outbreak of measles which was entered under small-pox, on account of the same vernacular name "*ai*" being common to both diseases.

More than a half of the total deaths were recorded under fevers. The number was 65,105 or 14·38 per 1,000, against 63,857 or 14·10 in 1886. The district death-rates ranged from 5·29 per 1,000 in the Khasi and Jaintia Hills to 34·73 in Goalpara.

Bowel complaints accounted for 16,913 deaths, equal to a ratio per 1,000 of population of 3·74 against 13,912 or 3·07 in 1886. Lakhimpur and Sibsagar districts continued to furnish the highest proportions of mortality under this head.

Lower Burma.

In Lower Burma the unsettled state of the country rendered the vital statistics for 1887 even less reliable than before. The registered births amounted to 79,420 as compared with 82,464 in 1886, the ratios per 1,000 of population being 21·74 and 22·57 respectively. The deaths numbered 59,115 or 16·18 per 1,000 against 56,783 or 15·54 in 1886. The year's ratios, the Government of India observe in their orders on the Sanitary Commissioners report, can hardly be held to represent the actual facts, especially if it be considered that the district ratios which formed the basis of these ratios varied in the case of births from a minimum of 8·95 to a maximum of 35·79 per 1,000, and in the case of deaths fram 7·77 to 22·13. Rangoon, the chief city of the province, recorded a birth-rate of only 15·14, and a death-rate of 27·13.

Deaths from cholera were less numerous than in 1886, the number having declined from 4,027 or 1·10 per 1,000 to 2,649 or 0·73. The disease, however, was spread over a large part of the province, as is shown by the fact that 63 townships out of 94 recorded deaths. Nearly half the mortality (1,061) occurred in Akyab district; and of the remainder, Amherst contributed 680, and Thongwa 278. The districts least affected were Mergui, Tavoy, Toungoo, and Thayetmyo. The months in which the greatest mortality occurred were March, April, and May.

Small-pox though more fatal than in the preceding year was below the average of the previous quinquennium. There were 228 deaths recorded, of which 134 or 59 per cent. were returned from the three districts of Bassein, Shwegyin, and Tharawaddy. Six of the 16 districts of the province were exempt from the disease. Of the total deaths 166 occurred among children under 12 years of age.

Deaths from fevers were also more numerous, and amounted to 31,825 or 8·71 per 1,000 against 28,444 or 7·79 in 1886. But it is presumed the Government of India observe, that if all the deaths due to this cause had found a place in the records, the total would have been still higher. Out of 14,811 villages not a single fever death appears to have been recorded in 6,310, which is hardly credible.

From bowel complaints 2,424 deaths were registered, being in the ratio of 0·66 per 1,000 of population against 2,512 or 0·69 in 1886.

IV.—JAILS.

Sickness and mortality in 1887.

THE general health of the prison population of India in 1887 was on the whole less satisfactory than in the previous year. Of an average daily strength of 70,832, which was over 5,000 below that of 1886, the admissions to hospital were in the ratio of 947 per 1,000 against 927, the daily sick rate 32, practically the same as in 1886, and the death-rate 35·48 against 33·34. The rise in the death-rate was due chiefly to increased mortality from cholera and in a less degree from bowel complaints. The most satisfactory feature exhibited by the year's statistics was the improvement in the Bombay, Bengal, and Assam jails. The former showed the best results of all the provinces; in Bengal the mortality was the smallest ever recorded; and in Assam the death-rate declined from 54·56 to 28·03 per 1,000. The Central Provinces jails returned the highest death-rate, viz., 65·77, identically the same as in the previous year.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1887, as compared with 1886.

Provinces.	1887.			1886.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal - - - -	1,421	45	32·73	1,361	44	37·01
Madras - - - -	614	22	23·03	714	24	18·01
Bombay - - - -	548	23	19·69	571	24	29·40
*Punjab - - - -	1,159	26	44·52	1,083	26	28·56
North-Western Provinces and Oudh	723	26	27·64	707	27	22·85
Central Provinces - - -	972	30	65·77	1,164	37	65·46
Berar - - - -	720	15	26·70	494	12	11·04
Assam - - - -	1,676	53	28·03	1,802	62	54·56
Lower Burma - - -	944	49	58·70	783	41	61·51
Coorg - - - -	1,490	48	56·60	1,781	52	67·01
India - - - -	947	32	35·48	927	32	33·34

* Excluding figures for subsidiary jails.

Bengal.

The health statistics of the jails in Lower Bengal for 1887 exhibit most satisfactory results. The death-rate from all causes (32·73) was the lowest yet recorded, the daily average number of sick was the smallest during ten years, and the rate of mortality from cholera (1·71 per 1,000) was lower than in any year since 1880. In all there were 42 admissions from cholera with 18 deaths. The disease did not appear in a severely epidemic form in any jail. The largest number of cases occurred in the Rungpore jail in the month of April, when cholera was very prevalent in the district. There was also a decided decrease in the number of deaths from dysentery and diarrhœa, as also from anæmia and general debility. Strenuous efforts have lately been made to improve the health of the prisoners confined in Bengal jails, and marked success has now crowned these measures. A test of this is given by the weighment results, only 19·3 per cent. of prisoners discharged from Bengal jails having lost weight as compared with 31·8 per cent. in the North-west.

Among convicts there were 363 deaths, or 33·2 per 1,000 of strength against 516 or 38·2 in 1886. Of this number 354 died in jails, of whom only 26·83 per cent. were received in good health, 41·81 per cent, in indifferent health, and 31·36 in bad health. "The extreme difficulty," the Inspector-General remarks, "of keeping alive a large "proportion of the convicts received in bad and indifferent health can only be realised "by those who have had some experience of the malaria-stricken population of the

" unhealthy districts of Bengal." About half of the deaths among convicts occurred within six months of their admission into jail.

The following statement gives the jails which recorded death-rates of over 50 per 1,000.

Jails.	Death-rate per 1,000 of Average Strength.		Jails.	Death-rate per 1,000 of Average Strength.	
	1887.	1886.		1887.	1886.
Khoolna - - -	253·6	51·6	Hooghly - - -	69·6	30·3
Rungpore - - -	104·3	63·6	Purneah - - -	62·4	78·2
Lohardugga - - -	98·8	21·7	Backergunge - - -	58·2	32·5
Dinagepore - - -	89·9	127·5	Balsasore - - -	53·3	13·4
Maldah - - - -	84·8	59·5	Rogra - - - -	53·0	23·3

The high death-rate of Khoolna is accounted for by the fact that it is practically a hospital, only the sick and feeble being retained there, while healthy prisoners are passed on to Jessore. Rungpore is one of the most malarious districts in Bengal, and of the 20 deaths in this jail 8 were admitted in bad health, and the remainder in indifferent health. In Lohardugga also the feeble state of health of the convicts on admission was the cause of the high mortality. It was reported that " fully 45 per " cent. of the prisoners admitted into this jail during the past year (1887) were in bad or " indifferent health, and they all more or less showed signs of scurvy, some in a very " aggravated form." The situation of Dinagepore Jail is a malarious one, still the health of the convicts was better than in 1886. In the other six jails the bad health of prisoners on admission was the chief cause of the high death-rates.

There was ample room during the year in the Bengal jails for the convict population. In a few jails the number of under-trial prisoners exceeded the capacity of the under-trial wards, but in those cases the excess number was invariably removed to empty convict wards. The filtered water of the Bhagulpore water-works was introduced into the Bhagulpore Central Jail in August 1887. The health of the prisoners in the Midnapore Central Jail has much improved since river water was used all the year round for drinking purposes. Filtered water from the Calcutta supply was shortly to be introduced into the Presidency Jail. The dry earth system was in force in every jail, and Dr. Warden, the chemical examiner, by an examination of the soils from different parts of the Presidency Jail garden, showed that the growing of a rapid succession of crops completely removed all trace of chemical products likely to prove dangerous to health.

Madras.

There was less sickness among the prison population of the Madras Presidency during 1887 than in the previous year, but the rate of mortality rose from 18·01 per 1,000 of average strength in 1886 to 23·03. Of the 27 jails in the Presidency, in 4 there were no deaths, in 10 the death-rate was under 20 per 1,000, in 7 it exceeded 20 per 1,000, but was under 40 per 1,000, and in the remaining six jails the death-rate was over 40 per 1,000. Notwithstanding that cholera was very prevalent in nearly all the districts during 1887, the disease did not show itself in any of the jails, and only one death occurred in the Bellary District Jail of a prisoner just admitted. Of individual jails the highest rate of mortality was recorded at the Parvatipur Jail, viz., 110·76 against 50·24 in 1886, and was due to the bad state of health of the prisoners on their admission. " Some," it is reported, " had to be actually carried to " the jail." Out of a total of 18 deaths in this jail, 15 occurred within six months of admission. The Rajahmundry Central Jail had the largest number of deaths (41) and a death-rate of 74·97 per 1,000 against 12·59 in 1886. A considerable portion of this mortality was due to an outbreak of *beri-beri* disease in an epidemic form among the newly-arrived Burmese. Out of the total 41 deaths 16 were thus accounted for, and if these are excluded the mortality would have been under 46 per 1,000. The high death-rate of 53·05 in the Cuddapah District Jail the Inspector-General reported as accidental. Of the 5 deaths in this jail 1 was due to pneumonia and 2 to phthisis pulmonalis. The Berhampore Jail returned a death-rate of 50·32 against 41·55 in 1886. All the deaths at this jail occurred within six months of admission, and were ascribed to the bad state of health in which the prisoners were received. Of the death-rates of the remaining jails it is interesting to note that Trichinopoly Central Jail has gone in six years from

from the top to the bottom of the list, its death-rate in 1882 having been 176·77 and in 1887 3·83.

Of the total 170 deaths in the Madras jails 147 occurred among convicts, giving a ratio of 23·20 against 17·73 in 1886, and of these 55 had been in jail less than six months, and 70 between six months and three years. Nearly a third of the mortality was due to dysentery and diarrhœa.

Bombay.

The health of the prisoners in the Bombay Presidency during 1887 was exceptionally good. The admission, daily sick, and death-rates were the lowest on record, the latter being 19·69 per 1,000 of average strength against 29·40 in 1886. The decrease was chiefly noticeable under bowel complaints and respiratory diseases, the deaths from the former having fallen from 53 to 33, and from the latter from 61 to 22. In 8 of the 26 jails there were no deaths, and in 10 the mortality was below the average of the Presidency, which is all the more satisfactory since many of them had been returning high death-rates for some years, notably the Yerrowda, Ahmedabad, Nara, Hyderabad, and Karachi jails. In eight jails the death-rate exceeded 30 per 1,000, excluding Godhra (125·0) and Ahmednagar (117·6), where the average daily strength was very small, and where only 1 or 2 deaths occurred. The only jails in which the death-rate was high were Kaira (106·2), Bombay House of Correction (51·5), Nasik (50·0), and Skikarpur (42·1). The high rate of mortality of the Kaira Jail was due to a serious outbreak of cholera, resulting in 6 deaths, just half of its total mortality. It is satisfactory to note that the death-rate among the Sind prisoners was very much reduced, the average ratio of the four jails being only 24·2 against 52·4 in the previous year. At Shikarpur the death-rate fell from 43·3 in 1886 to 42·1, at Hyderabad from 57·5 to 16·5, at Nara from 67·3 to 11·7, and at Karachi from 33·8 to 19·1.

Of the total 120 deaths which occurred during the year, 116 were of convicts, equal to a ratio of 21·0 per 1,000 against 30·3 in 1886, and of these 60 had been in jail under six months.

Punjab.

In the jails of the Punjab there was a marked increase in sickness and mortality during 1887 as compared with the previous year, the admissions into hospital per 1,000 of average strength having risen from 1,083 in 1886 to 1,159, and the number of deaths from 307 or 28·56 per 1,000 to 502 or 44·52. Under most of the principal diseases there was an increase both in the admissions and deaths, but chiefly from respiratory diseases and bowel complaints. Under the former heading the deaths among convicts rose from 94 or 9·42 per 1,000 of average strength to 137 or 13·19, and dysentery and diarrhœa carried off 145 or 13·96 per 1,000 against 84 or 8·42 in 1886. Of the 137 deaths from respiratory diseases 129 were from pneumonia alone. For five consecutive years up to 1887 there had not been a single death from cholera in the jails of the province, but in 1887 there were 76 cases, of which 66 were fatal, giving a death-rate of 6·35 per 1,000 of average strength. In all the jails in which the disease appeared prompt measures were taken for isolating the first cases, and only in one (Lahore Central Jail) did it break out in an epidemic form, resulting in 57 deaths or 34·21 per 1,000. In six of the total 34 jails no deaths were recorded; in nine there was a low mortality, not exceeding 14·7 per 1,000; and in 12 the mortality was high, six returning a higher death-rate than in 1886. In order they stood as follows:—

Lahore Central Jail	126·0	Bannu	53·5
Dharmsala	104·3	Hazara	45·4
Umballa	71·8	Amritsar	45·3
Chenawan	60·4	Hissar	43·0
Lahore District	57·0	Kohat	35·9
Lahore Female	56·0	Delhi	35·7

In the case of almost all these jails, "there are two general causes," the Inspector-General states, "to which the excessive mortality is considered by medical officers to "be chiefly due. The first is the unhealthiness of the season, malarial fevers, and "their usual sequelæ being very frequent among the prisoners as well as the free "population. The second is that partly in consequence of the distress arising out of "the high prices of food, partly in consequence of the unhealthiness of the season, "a large proportion of those admitted into jail were in a low state of health." In consequence of the continued unhealthiness of the Lahore Central Jail a committee of experienced officers was appointed to report on the matter. Their report was under the consideration of the local government, and steps were being taken to give effect as

far as possible to the recommendations of the committee. There appears, however, to be no doubt that the excessively high death-rates which have prevailed there for a number of years have been due to a certain extent to the concentration at Lahore of life or long-term prisoners physically unfit for transportation. According to length of residence in jail the mortality among convicts of under six months was 27·27 per 1,000; from six to 12 months, 46·51; from one to two years, 60·73; from two to three years, 63·78; and from three to seven years, 116·92. Among aged convicts the mortality was enormously high, the deaths numbering 179, equal to 80 per 1,000 of average number, and of these 103 occurred in the Lahore Central Jail.

North-Western Provinces and Oudh.

The health statistics of the jails of the North-Western Provinces and Oudh for 1887 show that there was slightly more sickness among the prisoners than in the previous year, and that the death-rate was the highest since 1880. The admissions to hospital were in the ratio of 723 per 1,000 of average strength against 707 in 1886, and the death-rate 27·64 against 22·85. Although cholera was prevalent throughout the province, deaths from this cause occurred at only 10 of the jails, and 4 of these returned but one death each. The total number of deaths from cholera was 52, and of these 19 occurred at Lucknow Central Jail and 14 at Agra. At most of the jails which recorded a high death-rate, it was explained by some external cause, such as the drafting away of healthy prisoners or the admission of sickly ones. For the most part the central and large district jails maintained a fair standard of health, some of them being particularly healthy. The mortality in some, notably the Meerut Aligarh, Cawnpore, and Lalitpur district jails, having shown progressive increase for several years, the local government directed the Inspector-General to inquire particularly into the causes in each case, and to report the result of his investigation.

Among the convict class there were 498 deaths or 27·72 per 1,000 of average strength, against a ratio of 22·40 in 1886. The chief causes of mortality were bowel complaints and respiratory diseases from which there were 154 and 88 deaths respectively.

Central Provinces.

There was less sickness in the jails of the Central Provinces during 1887 than in the previous year, the admissions to hospital having declined from 1,164 per 1,000 of average strength to 972, and the daily sick-rate from 36·88 to 29·81 per 1,000. Deaths, however, were slightly more numerous, and the ratio of mortality rose from 65·46 to 65·77. The increase of deaths was entirely due to a severe outbreak of cholera in the Sambalpur Jail, resulting in a mortality from this disease alone of 254·33 per 1,000, and to an epidemic of jaundice in Betul Jail. The ratios of mortality from all causes of these two jails were 386·79 and 328·54 per 1,000 respectively. Excluding the returns of these jails, the health statistics on the whole indicated much improvement. During the year the general administration of the jails was subjected to a thorough scrutiny by the Chief Commissioner, and many reforms were introduced which are expected to be beneficial to the health of the prisoners. Of the total 246 deaths 238 occurred among convicts, the ratio per 1,000 of average strength being 70·23 against 66·8 in 1886. The mortality was greatest, numerically as well as proportionately, among prisoners sentenced to less than six months for the jails as a whole, the number being 118, and the ratio per 1,000 of average strength 81·32. In several jails the accommodation was not sufficient, consequently there was overcrowding, but in no case was the health of the prisoners affected, and the circumstances were such, it is stated, as to render it difficult to afford immediate relief to the jails where overcrowding occurred. The Inspector-General was directed to give the matter his constant and careful attention.

Berar.

The year 1887 was generally unhealthy in Berar, and the jails suffered in common with the outside population. The average daily strength was less than in the previous year, but the admission-rate rose from 494 per 1,000 to 720, and the death-rate from 11·04 to 26·70. The greater portion of the increased death-rate was due to an outbreak of cholera of a virulent type in the Amraoti Jail, resulting in 13 deaths or in the ratio of 23·79 per 1,000 of strength, the total death-rate of this jail being 38·67. The other five jails were free from the disease. In all there were 25 deaths, including 8 from cholera, in the jails of Berar, and of these all but two occurred among convicts. There was temporary overcrowding in the district jails, which was met by transfers to the central jails. Of the total number of 1,963 prisoners discharged during the year, 278 were in the same physical condition as when they entered prison, 1,351 had gained weight, while 321 had lost weight.

Assam.

In the Assam jails there was a marked improvement in the health of the prisoners during 1887. The ratio of daily average sick (53) was lower than in any of the previous three years, and the ratio of deaths (28·03) than in any of the previous nine years. This improvement was mainly attributable to the almost entire absence of cholera, the deaths having decreased from 23 in 1886 to 1 in 1887, and to the general healthy character of the year. Some of the jails, however, showed an increase of admissions to hospital, mostly from fever, and a higher ratio of deaths, notably the minor jail of Sibsagar with its death-rate of 142·95 against 21·82 in 1886; but here, as in the jail population generally, the mortality was reported to have occurred chiefly among convicts who had served only a short time in jail. Of the total 46 deaths, 37 occurred among convicts, the ratio being 24·57 per 1,000 of average strength against 55·83 in 1886, and of these 25 had been less than six months in jail. During the year various sanitary improvements were carried out in the jails. Among them were the introduction of Brahmaputra water into the Gauhati Jail, the provision of plank beds at Sylhet, and the ordering of additional protection against wind and rain in all jails. It was also decided to abandon the use of the public tank outside the Sylhet Jail and to enlarge a smaller tank in the jail precincts, which it was hoped would afford a purer supply of water.

Burma.

In the Burma jails there was increased sickness among the prisoners during 1887 as compared with the previous year, but less mortality, the ratio of admissions per 1,000 of strength having risen from 783 to 944, while the death-rate fell from 61·51 to 58·70. Cholera was exceptionally fatal, the deaths numbering 109 out of a total mortality of 453 against 34 in the previous year. The disease was epidemic in a severe form in the jails at Akyab and Moulmein, and isolated cases occurred at Rangoon and Bassein. Moulmein suffered most severely, no less than four outbreaks having occurred during the year, resulting in 91 deaths, or in the proportion of 78·38 per 1,000. Excluding cholera this jail recorded the high mortality of 94·39. The Moulmein Jail has long been noted for its unhealthiness, and it has since been determined to abandon it.

As regards the prison population of Upper Burma, Mandalay was the only jail which was practically under the control of the Inspector-General during the year. Four other jails were in course of construction, and prisoners were confined in them, but statistics concerning them were not available. Mandalay Jail was visited by a serious epidemic of beri-beri, and had to be nearly emptied for a time. An inquiry concerning the causes of the epidemic was held, but no definite conclusion was arrived at. It is believed that the situation of the jail is not unhealthy, and that the epidemic was due to the unhealthy condition of the prisoners on admission and to the great change in their habits of life. The disease does not appear to have recurred in 1888.

V.—VACCINATION.

General results.

VACCINATION made fair progress in the various provinces of India during 1887–88. In every province more persons were vaccinated than in the previous year, and the average number of operations performed by individual vaccinators was greater. The total number of persons successfully vaccinated in the nine principal provinces during the year amounted to 5,202,595, and of these 2,022,059 were children under one year of age. As regards the vaccination of infants, the best results were obtained in Berar, where 75·5 per cent. of the births (estimated at 40 per 1,000 of population) were protected against small-pox. The Punjab came next, with a percentage of 59·1, followed by Bombay Presidency with 57·0, and the Central Provinces with 42·4; in the remaining provinces the percentages ranged from 11·1 in Lower Burma to 17·6 in the North-Western Provinces and Oudh. In all the provinces except Assam the percentages were above those of the previous year.

Bengal.

The benefits of vaccination have not yet been extended throughout the province of Bengal. The Vaccination Act is, however, in force in a number of towns, and during 1887–88 the area was greatly extended, embracing a population of over two and a half millions more than in the previous year. The total number of persons vaccinated in 1887 was 1,718,655, an increase of 108,378 on the previous year. Of this number 1,712,297 were primary operations, with success at the rate of 99·11 per cent, which was slightly below the percentage of 1886–87, viz., 99·25. The year's returns showed a slight improvement in the vaccination of infants, the number having increased from 223,460 or 11·0 per cent. of the births, estimated at 40 per 1,000 of the population, to 239,796 or 11·2. Throughout the province bovine lymph was largely and successfully used. The depôt for this lymph in the suburbs of Calcutta was found to be so useful that the Sanitary Commissioner suggested the establishment of similar institutions on a smaller scale in some of the large municipalities. There was a general tendency to improvement in the attitude of the people towards vaccination. In many places, however, great opposition was still shown. In Patna, where vaccination is very backward, there was great apathy and indifference, and in the town of Gya vaccination was received with feelings of aversion and hostility. The Act forbidding inoculation was extended during the year, and at its close was in force throughout the province, except in Chittagong, the greater part of Orissa, and a few districts in Behar. On the whole, the Sanitary Commissioner considered that great progress had been made in this respect, and that municipal commissioners had begun a more active administration of the law.

Madras.

The number of vaccine operations performed in the Madras Presidency during 1887–88 was considerably above that returned in 1886, and the quality of the work was better. Still the operations were fewer than in either of the three preceding years. The vaccinations in the year under notice amounted to 738,480, of which 724,225 were primary cases, the proportion of success being 94·3 per cent. against 94·0 in 1886. Of the total number of persons successfully vaccinated 148,895 were under one year and 392,652 were between one and six years of age, both being an improvement on the figures of 1886, and showing that early vaccination was comparatively more popular. Of the several establishments at work the outturn of the Local Fund vaccinators compared most favourably with that of the previous year. On the other hand, the work of the municipal vaccinators continued very unsatisfactory, in spite of vaccination having been made compulsory in many towns. In 15 towns there was a decrease in each of over 10 per cent. in the number of operations as compared with 1886. Animal vaccination was carried on in eight districts, and 13,587 operations were performed in this manner, but with a percentage of success of only 86·4. On the whole, the Madras Government did not think the work of the year was satisfactory, and they considered that if the officials and members of the various boards and councils concerned took a personal interest in the matter more could be done even with the existing staff, and his Excellency the Governor in Council looked to those whose influence was of value in the cause of vaccination to use it to the utmost.

Bombay. During 1887–88 the Vaccination Establishment of the Bombay Presidency was strengthened by the addition of one Inspector, one Assistant Superintendent, and 16 Vaccinators. With this additional staff the total vaccinations rose from 903,910 in 1886–87 to 929,545, showing a net increase in 1887–88 of 25,635 operations. Of these 879,755 were primary cases, with a percentage of success of 95·40 against 95·49 in the previous year. Of children under one year of age 583,700 were protected, equal to a percentage of 57·0 of the annual births estimated at 40 per 1,000 of population. The quality of the lymph in use throughout the year was reported to have been good. Human lymph was used everywhere except in Bombay, Poona, Rajkot, and Bandra, where animal lymph was either wholly or partially used. Inoculation, it is reported, was not practised anywhere in the districts, neither were any instances recorded of disease having been communicated through vaccination. The Compulsory Vaccination Act continued to work successfully in Bombay City, where it had been in force 10 years, and also in Karachi, where it had existed eight years.

Punjab. Satisfactory progress was made in vaccination in the Punjab during 1887–88. In all 680,742 operations were performed against 627,313 in the previous year, being an increase of 53,429. All but 55,198 were primary cases, and the percentage of successful vaccinations of this class (95·22) was slightly higher than in 1886–87. Estimating the births at 40 per 1,000 of population, the percentage of children under one year of age successfully vaccinated was 59·1.

The use of animal lymph was adopted by 14 districts, but only in Gujrat and the cities of Amritsar and Lahore was the plan carried out on an extensive scale. Buffalo lymph was becoming more appreciated by the people, and the Officiating Sanitary Commissioner had every reason to believe that when more extensively tried the results would prove highly satisfactory. During the year the Vaccination Act was extended to Simla by the Local Government, and draft rules for regulating vaccination operations in the town were under consideration.

North-Western Provinces and Oudh. The Vaccination Establishment of the North-Western Provinces and Oudh was increased during 1887–88 to the extent of 4 vaccinators, bringing the total staff up to 663. The total number of operations performed in the course of the year was 751,875 against 713,916 in 1886–87. Primary cases numbered 729,750 with a percentage of success of 93·4 as compared with 92·8 in 1886. Estimating the births at 40 per 1,000 of population 17·6 per cent. were successfully vaccinated during the year. As usual, the least work was done in the 2nd or Oudh circle, the difficulties there being greatest owing to the aversion which the rural population have to vaccination. In the districts of Gonda and Partabgarh the successful vaccinations did not reach 2 per 1,000 of the population.

Central Provinces. Vaccination work continues to make progress in the Central Provinces, and the popular prejudice against it is reported to be gradually disappearing. During 1887–88 the aggregate number of vaccinations performed amounted to 427,290, being an increase of 17,891 on the previous year. Of primary vaccinations there were 407,945, and of these 95·9 per cent. were successful. The number of infants successfully vaccinated was 182,330, equivalent to 42·4 per cent. of the annual births estimated at 40 per 1,000 of population. The great majority of the vaccinations was the work of the special establishment which was strengthened by the addition of 11 vaccinators during the year.

Berar. The total vaccinations performed in Berar during 1887–88 was 97,158 against 95,504 in the previous year. The results would have been still more satisfactory but for the necessity of employing the majority of the vaccinators on special cholera duty for nearly four months of the year. Of the year's operations 96,725 were primary cases, with a percentage of success of 96·1. The total number of children under one year of age protected by vaccination was 73,100, equal to 76 per cent. of the annual births estimated at 40 per 1,000 of population. The people of this province are generally averse to re-vaccination, but in accordance with the views of the Government of India, expressed in their Orders on the previous year's report, Superintendents were instructed to endeavour to popularise it, and wherever possible to operate upon all persons above 10 years old who had previously been vaccinated. At the same time they were cautioned not to force the operation wherever decided opposition was met with. The result was not very satisfactory, only 335 persons having been revaccinated; still this is an improvement on the figures of 1886–87 by 299. All the district superintendents reported that re-vaccination was in disfavour with the people,

and that to press it would prove detrimental to the working of the department. "Caution and judgment must therefore," the Sanitary Commissioner states, "be used "in inducing the people to accept re-vaccination."

Assam.

In Assam there were 231 vaccinators employed during 1887–88, being an increase of 17 on the number of the previous year. This was followed by an increase of the total vaccinations from 128,833 to 132,349. The primary operations numbered 131,111, of which 120,082 or 91·59 per cent. were successful. There was a considerable falling off in the number of primary operations performed in the tea gardens by garden agency, viz., from 6,933 in 1886–87 to 5,046 in 1887–88. The Sanitary Commissioner attributed this to a misconception on the part of managers and others that the work of vaccination in tea gardens devolves upon Government. Vaccination of people of the tea gardens is a sanitary measure required by the rules framed under the compulsory Act, and the duty of seeing that all children and other unprotected persons in gardens are properly vaccinated rests with the manager of the garden. A circular has since been issued clearly explaining the position, and the Deputy Commissioners of tea districts have been called upon to direct the attention of managers to their obligations in this matter. The number of infants successfully vaccinated was 21,960, representing 11·3 per cent. of the annual births estimated at 40 per 1,000 of population. In their Resolution on the previous year's report, the Government of India suggested that the religious prejudices against vaccination of certain sections of the province, might possibly be removed if buffalo lymph could be brought into practice, but the use of bovine lymph in the province has proved totally unsuccessful.

Lower Burma.

In Lower Burma 76,616 persons were vaccinated during 1887, exceeding the number of the previous year by 10,947. Of primary cases there were 68,159, of which 59,131, or 86·7 per cent. were successful. Children under one year of age were protected to the number of 16,661, equal to about a fourth of the registered births. Of the total vaccinations 73,847 were the work of the Vaccination Department, being 9,663 more than the number of the previous year. The increase occurred chiefly in the districts of Akyab and Hanthawaddy, including Rangoon town. Some districts showed a decrease, notably Prome, where 7,181 persons were vaccinated against 9,574 in 1886, and Toungoo, where the vaccinations declined from 831 to 215. In the case of Prome the decrease is stated to have been probably a fluctuation, but in Toungoo want of proper supervision appears to have been the cause. An inquiry into this case was to be made. It was also noticed that in several dispensaries no vaccinations were performed during the year, and the Chief Commissioner directed that medical officers in charge should make more use of the opportunities afforded them for performing vaccinations. "The readiness with which the people of this province "accept vaccination," he says, "affords a strong argument for the multiplication of "means of protection against small-pox."

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1886 and 1887, and the number of patients under treatment:—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1886	234	24,820	1,006,457	1,031,277
	1887	243	24,474	1,055,465	1,079,939
Calcutta and Howrah	1886	7	24,081	240,380	264,461
	1887	7	22,785	241,064	263,849
Madras	1886	316	39,602	1,977,557	2,017,159
	1887	344	42,148	2,128,139	2,170,287
Bombay	1886	222	36,444	1,576,677	1,613,121
	1887	230	37,123	1,657,710	1,694,833
Punjab	1886	194	41,893	1,806,390	1,848,283
	1887	202	43,770	1,989,123	2,032,893
North-Western Provinces and Oudh	1886	251*	48,299	2,061,179	2,109,478
	1887	259*	49,376	2,104,850	2,154,226
Central Provinces	1886	84	7,419	819,779	827,198
	1887	84	7,308	801,756	809,064
Berar	1886	42	2,345	232,250	234,595
	1887	43	2,360	246,150	248,510
Assam	1886	50	3,664	152,731	156,395
	1887	59	3,593	185,994	189,587
Lower Burma	1886	34	14,485	184,089	198,574
	1887	35	15,079	197,059	212,138
Coorg	1886	2	574	21,078	21,692
	1887	2	423	14,879	15,302
Total	1886	1,436	243,626	10,078,567	10,322,193
	1887	1,508	248,439	10,622,189	10,870,628

* Statistics were furnished for only 226 in 1886 and for 234 in 1887.

Bengal.

Nine new charitable dispensaries were opened in Bengal during 1887, raising the total number to 243. The total number of patients under treatment was 1,079,939 against 1,031,277 in 1886, and of these 24,474 were in-patients, being a decrease of 346 on the number of the previous year. The increase in out-patients was 49,008, and was accounted for by the opening of new dispensaries, and to the great unhealthiness of a few localities. The death-rate among the in-door patients decreased from 144·8 per 1,000 in 1886 to 127·1, which does not correspond with the increased mortality among the general population from 21·99 per 1,000 to 23·46, and which leads to the conclusion that the dispensaries are not as a rule resorted to by the people as largely as might be wished. The diseases most prevalent during the year were cholera, rheumatic affections, liver, worms, spleen diseases, skin diseases, and ulcers. There was a fair increase both in the number of major and minor operations which rose from 3,454 and 52,620 in 1886 to 4,139 and 54,189 respectively in 1887.

The following table shows the extent to which the public resorted to the Calcutta Medical institutions during 1887, as compared with the previous year:—

Medical Institutions.	1887.				1886.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	5,953	48,518	54,471	105·1*	5,880	49,985	55,865	101·7*
General Hospital	2,966	—	2,966	41·13	3,696	—	3,696	38·69
Mayo Institutions	2,736	179,249	181,985	35·5	2,697	177,817	180,514	104·5
Campbell Hospital	6,432	—	6,432	210·35	7,313	—	7,313	198·68
Municipal Police Hospital	2,738	—	2,738	8·4	2,396	—	2,396	12·1
Voluntary Lock Hospitals	458	2,214	2,672	45·85	484	1,629	2,113	47·52
Total Calcutta Hospitals	21,283	229,981	251,264	111·9*	22,466	229,431	251,897	110·63*
Howrah General Hospital	1,502	11,083	12,585	183·7	1,615	10,949	12,564	167·8
Grand Total	22,785	241,064	263,849	116·73*	24,081	240,380	264,461	116·49*

* Reckoned on cases treated, exclusive of ophthalmic cases.

It will be seen from the above that the total number of in-door patients at all the Calcutta hospitals fell by 1,296, while that of out-door patients rose by 684. The total death-rate for all the hospitals was 116 per 1,000, the same as in 1886, and lower than in any other year since 1880. That the attendance at the hospitals does not bear any relation to the death-rate among the general population is shown by the fact that the total attendance was larger during 1886 and 1887 than in 1884 and 1885, when the rate was much higher. The very high death-rates in the Campbell Hospital and the Howrah General Hospital were attributed to the large number of destitute and moribund patients annually admitted to those institutions. The number of admissions for dysentery rose by 102, from 1,601 in 1886 to 1,703, but the deaths declined from 455 to 447. There were 612 cases of cholera treated, 341 of which proved fatal against 781 cases and 424 deaths in 1886. The total admissions for venereal diseases numbered 14,492, against 13,860 in 1886. There were 1,488 major surgical operations performed during the year, as against 1,561 in the previous year; and of these only 81 or 50·81 per 1,000 proved fatal, as against 64·07 in 1886. The number of minor operations also decreased from 19,040 to 16,487. In the Eden Hospital the total number of obstetric cases increased from 1,541 to 1,607. The number of confinement cases was 439 with 25 deaths, against 445 in the previous year with 17 deaths. The increase in the number of deaths was due to the prevalence of septicæmia in the hospital, but measures were being taken to prevent this from occurring again. The nurses employed in the hospitals continued to give great satisfaction, and the superintendence of the ladies of the Clewer Sisterhood was again recognised as of the utmost value.

Madras.

There were 344 hospitals and dispensaries in operation in the Madras Presidency during 1887, of which 29 were new ones. In the total number of patients under treatment there was an increase of 153,128, the number having risen from 2,017,159 in 1866 to 2,170,287. Of these 2,128,139 were out-patients, and 42,148 were in-patients, the former being 150,582 more than the number in the previous year, and the latter 2,546. Of the in-patients 27,837 were cured, 5,816 relieved, and 2,994 died, the rate of mortality being 71·0 per 1,000 against 69·0 in 1886. The principal diseases treated were those of digestion, the eye, skin diseases, ulcers, and malarial fevers. There was a diminution in the number of cases of paroxysmal fevers and small-pox as compared with the previous year, but cholera cases were considerably in excess, numbering 8,188 against 1,505. For some few years there has been a steady increase in the number of surgical operations performed, and in 1887 they amounted to 63,409 against 61,737 in 1886. Of these, 5,154 were major and 58,255 were minor operations. Of the former 4,174 were successful, 473 relieved, 195 discharged, and 212 were fatal. The fatal cases were therefore in the ratio of 4·11 per cent. of operations.

Bombay.

Eight new dispensaries, including the Allbless Leper Home at Trombay, were opened in the Bombay Presidency during 1887, bringing the total up to 230. At these 1,694,833 patients were treated, of whom 37,123 were in-patients against 36,444 in 1886, and 1,657,710 were out-patients against 1,576,677. Altogether there was an increase of 81,712 patients as compared with the previous year. The increase was attributed partly to the opening of the eight new dispensaries which were attended by

15,732 patients, and partly to the growing confidence of the people in European treatment of disease. Of the 37,123 in-patients 25,928 were cured, 3,801 relieved, and 2,586 died; the ratio of deaths being 69 per 1,000, practically the same as that of 1886. There were over 4,000 more patients treated for cholera than in 1886, when there were only 55 cases, and over 23,000 more for skin diseases; there was also an increase in cases of leprosy, malarial fevers, rheumatic and respiratory affections, whilst cases of venereal diseases were somewhat less numerous. The number of surgical operations performed during the year was 78,437 of which 4,779 belonged to the major class, and of these latter 3,976 were successful and 138 were fatal, the percentage of deaths being 2·9 against 3·9 in 1886, "an exceedingly favourable result," the Surgeon-General states, "considering that in many cases patients are admitted in "an advanced state of disease."

Punjab. In addition to the 194 hospitals and dispensaries at work in the Punjab at the close of 1886, eight new ones were opened during 1887, making a total of 202. At these 2,032,893 patients were treated against 1,848,283 in 1886, the in-patients numbering 43,770 and the out-patients 1,989,123, as compared with 41,893 and 1,806,390 respectively in the previous year. This increase of over 9 per cent. of the total number treated in 1886 was accounted for by the unhealthiness of the year and by the extra number of institutions working. To the unhealthiness of the year was also due the higher death-rate among the in-patients, which was in the ratio of 55·3 per 1,000 of the total of such patients against 46·9 in 1886. As usual, malarial fevers, of which there was an increase of over 70,000 patients, ulcers, diseases of the respiratory and digestive organs, and ophthalmia, claimed the largest proportion of patients. Over 5,000 cases of cholera were treated against only 9 cases in 1886. Good work was done at the Maternity Hospital at Amritsar, and also at the Lady Aitchison Hospital for Women at Lahore. At the latter Dr. Elizabeth Bielby performed 41 major surgical operations five only of which terminated fatally. In the total number of operations performed during the year there was an increase of 10,962 as compared with the previous year. The increase, however, was only in the minor cases, as the major operations declined from 13,311 in 1886 to 10,894. It is explained that the 13,311 major operations, said to have been performed in 1886, were found to include many which were not strictly major operations, and it became necessary in 1887 to enjoin a stricter classification; hence the decrease in numbers.

North-Western Provinces and Oudh. Nine new dispensaries were opened in the North-Western Provinces and Oudh during 1887, bringing the total up to 259. Statistics were furnished for 234 of the total number, and at these 2,154,226 persons received relief against 2,109,478 patients treated at 226 institutions in 1886. The out-patients (2,104,850) increased by 43,671, or 2 per cent., and the in-patients (49,376) by 1,077 or 2·2 per cent. Of the former class, 28,882 were cured, 8,859 were relieved, and 3,106 or 62·9 per 1,000 died, the mortality being 5 per 1,000 greater than in the previous year. Of the diseases under treatment there were 361,021 cases of fever or 20,000 less than in 1886; cases of spleen disease (37,226) also showed a falling off of 6,000 cases. On the other hand, cholera cases increased from 2,926 in 1886 to 14,740; there was also an increase of 8,000 in the cases of bowel complaints, and of 6,000 in diseases of the respiratory organs. Including 80,736 patients treated at the eleven missionary stations against 71,760 in the preceding year, and 74,319 at 14 private dispensaries against 68,740 at 13 such institutions increases the above total of patients under treatment to over 2¼ millions. The total number of operations performed during 1887 at the 234 institutions was 110,717 or 2,850 less than in the previous year. The decrease was in the minor operations, the major cases having risen from 15,237 to 15,395. Of these, 11,251 were cured, 1,940 were relieved, and 256 were fatal. The mortality in all the operations was only 1·6 per cent.

Central Provinces. The total number of dispensaries open in the Central Provinces during 1887 was 102 or one more than in 1886. New dispensaries were opened at Saugor (City branch), and at the head-quarters of the Bastar Feudatory State, while the Kamptee dispensary, having been made over to the military authorities, was excluded from the returns. The number of dispensaries maintained either wholly or in part from public funds was 84, the same number as in the previous year. At these 809,064 patients were treated, 7,308 being in-patients, and 801,756 out-patients. Taking the figures of only those institutions which were open in both years, there was but slight difference in the total attendance. Of the in-patients, 5,012 were cured, and 802 or 109·7 per 1,000 died, which is an increase of over 21 per 1,000 on the mortality of

1886. The diseases which gave rise to the largest increase were fevers, cholera, bowel complaints, worms, and skin diseases. There was a slight increase in the amount of surgical work done during the year, the number of major operations having risen from 878 to 891.

Berar. The number of institutions for medical relief in Berar was increased in 1887 by the opening of one new dispensary, making a total of 43. The number of patients treated rose from 234,595 in 1886 to 248,510, of whom 2,360 were in-patients, and 246,150 were out-patients. The increase was attributed partly to the unhealthiness of the year, partly to the opening of the new dispensary, and in some measure to the growing popularity of the institutions. Of the in-patients, 2,008 were cured, 88 relieved, 43 discharged, and 137 died. The average death-rate rose from 39 per 1,000 in the preceding year to 58 in 1887, which was explained by the fact that many patients were admitted into the hospitals in a dying condition. Fevers, with 37,232 cases, were, as usual, the chief causes of admission, next in order of intensity came diseases of the skin (28,334), ulcers (23,187), worms (18,257), and diarrhœa (13,708). The number of major operations performed rose from 284 in 1886 to 335, of which 275 were successful, and 20 were fatal. With a view of rendering the dispensaries more self-supporting, the question of introducing a moderate scale of fees leviable from well-to-do patients was revived at the close of the year.

Assam. The number of dispensaries working in Assam at the close of 1887 was 59, an increase of 9 upon the previous year. There were 189,587 patients under treatment, or 33,192 more than in 1886. The increase was entirely among out-patients, as the in-patients declined from 3,664 to 3,593. Of these 2,012 were discharged as cured, 305 were relieved, and 697 or 173·9 per 1,000 died. "These figures," the Sanitary Commissioner states, "sufficiently explain the reluctance with which the better classes "resort to these institutions for hospital treatment. The fault rests less with the "skill and humanity of the medical officers than with the abject destitution of "impoverishable immigrants who are admitted in the last stages of disease induced "by exposure, privation, and want." Of the several diseases, malarial fevers claimed 39,959 of the total patients under treatment, skin diseases 34,535, worms 18,123, diseases of the digestive organs 12,876, and rheumatism 8,572. A special feature of the year's work was the marked improvement in the attendance of women and children, the daily average attendance of the former as out-patients having increased from 109·53 to 125·99, and of the latter from 145·23 to 181·66. The usefulness and popularity of hospital treatment in the province was further exemplified in the results of surgical operations. The number of major operations has steadily increased from 148 in 1883 to 397 in 1887. Of these 331 were cured, 28 relieved, 20 otherwise discharged, 10 died, and 5 remained under treatment. In the number of minor operations there was also a slight increase.

Lower Burma. Two new dispensaries were opened in Lower Burma during 1887, and one was closed, leaving 35 at work at the end of the year. In these there were 15,079 in-patients and 197,059 out-patients under treatment, which is a satisfactory increase on 14,485 and 184,089, the respective numbers in 1886. Of the in-patients 11,291 were cured, 790 were relieved, and 1,039 died; the death-rate being 68·8 per 1,000 against 70 in the previous year. Most of the dispensaries contributed to the year's increase in patients, but in a few there was a falling off, the most notable cases being Bassein and Shwedaung, where the diminution in in-patients as compared with the preceding year was so marked that the Local Government directed that the matter should be inquired into. The number of surgical operations performed during the year (5,429 against 4,479 in 1886) testifies to the popularity of hospital treatment in the province. It was noticed in Vol. XX., p. 27, that with the view of affording medical aid to women arrangements had been made for establishing a lying-in hospital at Rangoon under the auspices of the branch of the Countess of Dufferin's fund. This hospital was well attended during the year, and instruction in midwifery was given to a number of Burmese female students. In the course of the year standards for examination in midwifery and sick nursing were prescribed by the Educational Syndicate and ten municipalities, among them Mandalay, showed a praiseworthy liberality in establishing scholarships for women to be held at the hospital established by the Committee.

Lock Hospitals.

Bengal.

The total admissions to the two voluntary lock hospitals in Calcutta for venereal diseases during 1887 was 2,672 against 2,113 in 1886. The increase was in out-door patients, as the in-door patients declined from 458 to 484, all but 28 being natives.

The general results of the working of the 4 cantonment lock hospitals in Bengal during 1887 show an improvement at Dinapore and Barrackpore, while at Dum Dum the results were practically the same as in 1886, and at Darjeeling very unsatisfactory. At Dinapore the admissions were in the ratio of 99·32 per 1,000 of an average strength of 443 against 152·37 in 1886, the decrease being attributed to the system of segregation of women. Out of a total of 44 cases only in 14 was disease contracted from women of the cantonment. At Barrackpore the ratio of admissions of an average strength of 244 was 512·2 or 145·6 per 1,000 less. Illicit prostitution with the class of prostitutes professing not to receive Europeans, was reported to be carried on to a great extent at this station. Of the total 125 cases, disease was contracted at Barrackpore only in 32; in 80 cases it was said to have been contracted elsewhere; and the remaining 13 cases were relapses, &c. The average strength of troops stationed at Dum Dum during 1887 was 627, and among them there were 158 admissions for venereal disease, being in the ratio of 252·06 per 1,000 against 222 admissions, or a ratio of 254 82 in the preceding year. Only 23 of the 158 cases were contracted at the station. It is reported that the number and virulence of venereal cases contracted in Calcutta became so great that the men's passes to that city had to be stopped, the result being that the admissions immediately diminished by more than a half. The admissions into the Darjeeling lock hospital were in the proportion of 341·91 per 1,000 against a ratio of 269·05 in the previous year. The cause of this increase was again attributed to paucity of prostitutes. The number of women found diseased and admitted into hospital was greater at Barrackpore and Dum Dum than in 1886, and less at Dinapore and Darjeeling.

Madras.

The Contagious Diseases Act is reported to have worked smoothly in Madras City during 1887. The total number of women inspected was 17,738, and of these 558 were found diseased and sent to the lock hospital.

Military lock hospitals were maintained at eight stations in the Madras Presidency during 1887, and at these, with an average strength of 8,676, the admissions for all forms of venereal disease numbered 3,056 or 352·23 per 1,000 against a ratio of 253·07 in 1886. The increase, however, was mainly owing to the inclusion of admissions for certain forms of disease which were excluded in the returns for 1886. From primary syphilis the number of admissions declined from 637 to 558. "The noteworthy feature in the working of the lock hospitals during the past year," the Surgeon-General of Her Majesty's forces in Madras says, "has been the decrease in the admissions amongst British troops for venereal diseases at Bellary, and particularly at Cannanore, as compared with the periods during which these institutions were closed during 1886. The effect has been especially noticeable at Cannanore, where, in 1886, when the lock hospital was closed from 1st January to 15th July, there were 146 admissions for venereal during the six and a half months out of an average strength of 413, while during the year under report there were only 44 admissions for the whole year out of an average strength of 155. These figures would seem to afford additional evidence as to the value of the lock hospital system in checking the prevalence of a disease, the consequences of which to British troops serving in India are so deplorable."

The average number of registered women at the eight stations was 695, among whom there were 2,119 admissions to hospital, showing that each woman was detained for treatment three times during the year.

Bombay.

The Contagious Diseases Act was suspended in Bombay City on the 1st July 1888. On the 30th June 1,479 prostitutes and 247 brothels were on the register. During the 13 months ending on that date 12,641 examinations were made—5,913 during the six months ending with November, when 3·1 per cent. were found diseased, and 6,728 in the remaining seven months, when the percentage was 5·3.

Lock hospitals were maintained at 12 stations in the Bombay Presidency during 1887, and at these the average admissions for primary syphilis and gonorrhœa were in the ratio of 221 per 1,000 of average strength against 291 in the previous year.

The station ratios varied from 344 per 1,000 at Kirkee to 101 at Karachi. The extension of the Contagious Diseases Act to Satara, and the establishment there of a small lock hospital were sanctioned by the Government of India; but the operation of the Act having since been suspended in all places in which it was in force, its introduction into Satara was abandoned.

Punjab.

Among the troops in the Punjab venereal disease was less prevalent in 1887 than in the previous year. Lock hospitals were maintained at 16 stations, but statistics were available for only 15. Of these 10 showed a decrease of disease and five an increase. The improvement was most marked at Sabathu, Naushahra, and Rawalpindi, "and the fact that at each of these stations the average strength of troops was higher "in 1887 is additional evidence that the system has worked well." At Sabathu the admissions declined from 950·38 per 1,000 of average strength to 452·48, at Naushahra from 305·03 to 91·62, and at Rawalpindi from 448·17 to 212·67. The average admission rate of the 15 stations was 273 per 1,000 of average strength against 351 in 1886.

North-Western Provinces and Oudh.

Eighteen lock hospitals were open in the North-Western Provinces and Oudh during 1887, against 14 in the previous year, the four which were closed as a tentative measure having been re-opened. The average strength of European troops at the 18 stations was 14,383, and among them the ratio of admissions on account of venereal disease was 309 per 1,000, as compared with 295 per 1,000 at 14 stations in 1886. There was thus an increase of 14 per 1,000 in 1887, which occurred in 9 out of the 14 stations where hospitals were maintained in the previous year, the most marked case being Ranikhet, where the increase was attributed to the inclusion for the first time of 227 cases of non-specific ulcer. Moradabad was the only station which showed a material decrease, the ratio of admissions having fallen from 757·4 per 1,000 in 1886 to 228·9 in 1887. "It is unlikely," the Sanitary Commissioner remarks, "that the "prevalence of venereal disease will ever become much less than it now is, until the "soldier is educated to be the responsible guardian of his own health."

Central Provinces.

The returns of the four lock hospitals in the Central Provinces for 1887 show that the ratios of admissions per 1,000 of average strength for venereal diseases among European troops were higher in two hospitals and lower in two, as compared with the previous year. At Jubbulpore and Pachmarhi the ratios declined from 481 and 368 per 1,000 respectively to 378 and 150, while at Kamptee the ratio rose from 347 per 1,000 to 510, and at Saugor from 168 to 320 per 1,000. It was thought probable that the increase in Saugor and decrease in Jubbulpore were due to the same cause, the transfer from the former station to the latter at the end of 1886 of a battery of Royal Artillery, whose statistics show it to be exceptionally free from venereal disease. The garrison at Pachmarhi is so small (average strength 93 in 1887) that the large decrease in the ratio was looked upon as an unimportant fluctuation. The Kamptee ratio was very high. "There seems," it is reported, "a steady increase in the prevalence of disease "among the troops in this cantonment, which calls for the earnest attention of the "authorities concerned." The more serious forms of disease, however, were not so prevalent, the greater number of admissions having been from local diseases, such as ulcers.

Lower Burma.

Lock hospitals were maintained during 1887 at Rangoon, Bassein, Thayetmyo, and Toungoo. The number of women licensed during the year was 351, and the number on the register was 703, while the number found diseased and detained for treatment was 652. Venereal disease was more prevalent among the troops in Rangoon than during the previous year. The Government of India drew attention to the increased prevalence of disease in this cantonment in 1886, and instructed the Chief Commissioner to take steps to have the lock hospital rules more strictly enforced. Orders were accordingly issued on the subject in the latter part of 1887, but with what result is not yet known.

Lunatic Asylums.

Bengal.

During 1887 the number of persons under treatment at the 5 lunatic asylums in Bengal was 1,137, being a decrease of 36 in the number of the previous year. Of these 168 were new admissions and 13 re-admissions. By the end of the year 88 had been discharged cured, 39 committed to the care of friends, 2 otherwise disposed of, and 86 died, leaving 922 still under treatment. The above population included 487

criminal lunatics, and of these 75 were discharged or transferred, and 28 died. A committee was appointed to inquire into the conditions under which it becomes safe to release criminal lunatics, whose numbers have of late years increased. Their report was received after the close of the year, and rules for guidance in such cases have since been promulgated. Of the total number of patients confined for mental disease 116 were classed as suffering from mania and 32 from melancholia. The excessive use of ganja, which is said to be the most potent factor in the production of insanity in the province, accounted for 247 cases, and 54 others were reported as due to spirits. Of 132 cases attributed to moral causes, 89 were due to grief, 9 to fear, 13 to jealousy, and 21 to other causes. Except at Dullunda and Berhampore the health of the patients was fairly good. In the former the sick list was swollen by an epidemic of chicken-pox and by a prevalence of fevers, and at the latter by bowel complaints and fevers. Notwithstanding that cholera was more or less prevalent in the localities in which the asylums are situated, only 2 cases occurred at Dallunda, 1 at Dacca, and 1 at Berhampore. The general death-rate was 91·1 per 1,000, "which," the Inspector-General says, "is not high in a country like Bengal, where fevers and bowel complaints "are common."

In the European asylum at Bhowanipore 53 lunatics were under treatment, of whom 21 were new admissions and 3 re-admissions. Of these 8 were discharged cured, 2 were made over to military authorities, 2 were despatched to Europe under the Merchant Shipping Act, 4 were transferred to the care of friends, 2 were deported to Europe as still insane, and 4 died. The causes of insanity were chiefly intemperance, heredity, and epilepsy.

Madras. In the three asylums in the Madras Presidency 797 lunatics were under treatment during 1887 against 768 in the previous year. The admissions, including re-admissions, amounted to 207. The number discharged was 124, and of these 73 were cured, 24 transferred to friends, and 27 otherwise discharged. There were 46 deaths, being in the ratio of 74·0 per 1,000 of average strength, against 33 deaths or 50·0 per 1,000 in 1886. Of the total number of lunatics treated 363 were classified as cases of mania, 240 as dementia, and 51 as melancholia. Of the three asylums, that of Madras was the most unhealthy. The daily average number of sick was 19 out of an average strength of 450, being, with one exception (1880–81), the highest number in the last 11 years, and the death-rate rose from 66·8 per 1,000 in 1886 to 88·7. These unfavourable statistics were due in a great measure to the heavy mortality among newly-admitted patients, the death-rate among them being as high as 266·6 per 1,000. The health of the patients in the other two asylums is reported to have been everything that could be desired. The daily average number of sick continued to be extremely low, and the death-rate, 38·3 per 1,000 in Vizagapatam and 33·9 in Calicut, were considered very moderate. The criminal lunatics numbered 162, of whom 54 were fresh admissions. Besides these, several were under detention in jails for want of room in the asylums. By the close of the year 19 had been discharged and 9 died, leaving 134 still under treatment against 108 in 1886.

Bombay. The number of lunatic asylums in the Bombay Presidency (six) remained unchanged during 1887. Their total population was 913 as compared with 887 in 1886. Of this number 222 were new admissions and 20 were re-admissions. The number discharged in the course of the year was 176; 67 as cured, and 54 died; leaving 683 in confinement at the end of the year. The general health of the patients was on the whole satisfactory. The mortality was not considered excessive, being in the ratio of 79·5 per 1,000 of average strength, identically the same as in the previous year. Out of 424 cases in which the causes of insanity were known, 344 were of a physical nature, and 80 were due to moral causes. Of the former class ganja was credited with 142 cases, spirits 42, and opium 10. Criminal lunatics numbered 123, and of these 14 were discharged during the year and 8 died, leaving 101 under treatment on the 31st December, or 3 more than the number with which the year opened. The Surgeon-General with the Government of Bombay reported that the conservancy of all the asylums was carefully attended to and was good, but that at two (Colaba and Ratnagiri) the supply of water was deficient.

Punjab. The population of the two asylums in the Punjab, viz., Lahore and Delhi, during 1887 was 487, or 26 less than in 1886. Of this number 50 were discharged cured, and 29 were made over to their friends. Seventy-two of the inmates were criminal lunatics, of whom 18 were admitted during the year. The year was an unhealthy one

at both of the asylums, owing to malarious fevers which were very prevalent. In the Lahore asylum there were 434 admissions into hospital, with 37 deaths, against 329 admissions and 21 deaths in 1886; and at Delhi the numbers for 1887 were 124 and 13 respectively, against 118 and 11 in 1886. The chief causes of death were pneumonia, dysentery, and diarrhœa. The question of an improved water-supply for the asylums was under the consideration of the Local Government. The Superintendent of the Lahore asylum reported that the building was utterly unsuited to the requirements of such an institution, and he recommended the construction of an entirely new asylum on a proper plan. This proposal having met with the support of the Inspector-General of Civil Hospitals, the Government informed that officer that the proposal might be made the subject of a separate representation, if he was of opinion, with reference to the pressing need for economising provincial finances, that the expenditure must sooner or later be incurred.

North-Western Provinces and Oudh.

The total number of patients under treatment in the four lunatic asylums of the North-Western Provinces and Oudh during 1887 was 1,254 against 1,309 in 1886; the new admissions amounted to 313. By the close of the year 132 had been discharged cured, 28 made over to their friends, 18 otherwise discharged, and 105 died, leaving 968 still in charge. Although the year was generally unhealthy the mortality in the asylums was about the same as in 1886, the ratio per 1,000 of average strength being 109. Altogether there were only four cases of cholera, despite the epidemic which prevailed in certain districts, and the Benares asylum was free from the disease. Of the four asylums, that at Lucknow recorded the highest death-rate, 175 per 1,000, Bareilly following with 116, Benares with 86, and Agra with 73. The Inspector-General of Civil Hospitals having reported that the asylum premises at Lucknow were ill-built and ill-drained, and that previous uses of the site must have polluted the subsoil, projects of improvement were about to be submitted to Government. Chronic mania and chronic dementia were the most frequent types of disease, except at Lucknow, where cases of acute mania were in singularly large proportion. The use of intoxicating drugs, especially of charas and ganja, was again shown as the most frequent physical cause of insanity. All the asylums were inspected during the year by the Inspector-General, when he found the management efficient and sympathetic.

Central Provinces.

There were 333 lunatics under treatment in the two asylums (Nagpur and Jubbulpore) of the Central Provinces during 1887 against 342 in 1886. Of these 56 were fresh admissions. The number of patients discharged was 45, of whom 29 were cured. Among the 184 patients in the Nagpur asylum there were 25 deaths, being in the ratio of 180 per 1,000 of average strength, against 143·5 in 1886, and among the 149 patients in the Jubbulpore asylum the deaths numbered 9, or 66·3 per 1,000, against 74·9. In the former, fever was the chief cause of mortality, and in the latter, general debility. In consequence of the great difference between the vital statistics of the two asylums in 1886, especially in respect of bowel complaints, the Government of India suggested an assimilation of the diet scales, as far as practicable. "This," the Chief Commissioner states in his Resolution on the report for 1887, "had already "been adopted, but the Deputy Surgeon-General is of opinion that the new scale has "not been long enough in force at Nagpur to admit of a judgment being passed on "the effect of its introduction. Nor does the difference between the two asylums in "respect of vital statistics seem to be attributable to the forms of labour on which "the patients are employed, or to other conditions of management. The Superintendent of the Nagpur asylum has given details of the histories of all the patients who "died during the year. These descriptions show clearly that in no one case can "death be ascribed to any cause connected with the treatment or conditions of the "asylum, and in most of these cases the patients had been kept alive by force in spite "of themselves. The sickness and mortality in the Nagpur asylum can apparently "be only attributed to the characteristics of the insanity of the inmates; and possibly "the fact that the Jubbulpore asylum has, as noted last year, more idiots and comparatively fewer demented and maniacs, may affect the ratio of the vital statistics. "There may also be something in the fact that so many of the Nagpur cases are those "of ganja smokers."

Assam.

In the Tezpur Lunatic Asylum, Assam, there were 105 patients under treatment in 1887, as compared with 95 in 1886. Of these 38 were fresh admissions. The number discharged as cured was 16, and the deaths 11 or 154 per 1,000 of average strength.

Two of the 11 deaths were accidental, and 5 were cases reported to have been helpless from the beginning. The Deputy Surgeon-General, however, was not altogether satisfied with the explanation of the high mortality, as the two fatal accidents (one of which was a case of suicide) were due to causes which he thought might have been foreseen and guarded against. There was also an occurrence of successful homicidal mania. A criminal insane, who had been in the asylum six months, suddenly snatched a hoe from one of the working gang, and attacked the warders, who ran away. The lunatic turned on the compounder of the asylum and killed him. The warders have since been armed with batons, and handcuffs have been provided for restraining refractory lunatics. Several sanitary improvements were effected in the asylum during the year. Night latrines were added to the wards, the old wells closed, and a new well dug.

Lower Burma.

The number of lunatics under treatment in the Rangoon asylum during 1887 was 323, of whom 96 were new admissions, against 281 in the previous year. To some extent the increase in 1887 was due the annexation of Upper Burma, which sent 9 lunatics to the asylum against 3 in 1886. There were discharged 73 patients, 54 as cured, and 23 died. Out of the total 323 cases of insanity, 79 were attributed to physical causes and 100 to moral causes, such as grief, fear, &c. The deaths were in the ratio of 102·8 per 1,000 of average strength, being 19·7 per 1,000 more than that of the previous year. The increased mortality was looked upon as an accidental fluctuation.

Medical Schools.

Bengal.

The total number of medical students in Bengal at the close of the session of 1887–88 was 887 (including 23 females) against 965 in the previous year. On the opening of the session in the Calcutta Medical College, 172 students continued their studies, 9 rejoined, and 73 new students were admitted, making a total of 254 against 234 in 1886–87. At the close of the session 7 hospital apprentices left for regimental duties, 5 Burmese students passed and returned to Burma, 6 senior and 3 junior scholars, 56 paying and 5 free students ceased to attend, and the strength was further reduced to 160 by dismissal and other causes. The number of students in the free female class increased from 11 to 21. In 1888 nine candidates passed the First M.B. examination—two in the first and seven in the second division—a lady heading the list of successful candidates; six candidates passed the second M.B. examination; 16 candidates passed the First and nine the Second L.M.S. examination; and one candidate passed the examination in honours in medicine and surgery. The Campbell Medical School, Sealdah, had 198 students on its rolls. Out of 74 second-year students who appeared for the first License examination, 59 passed, the remaining 15 were all rejected in Materia Medica. For the second or final License examination, 46 third-year students appeared and 40 passed. Of 88 first-year students 82 received promotion. A class for instructing females through the medium of the vernacular was opened in June 1888 in this school, and 15 students were admitted. At the Dacca Medical School there were 229 pupils on the rolls at the close of the session. Fifty-three third-year students appeared at the second License examination, of whom 30 passed, and 56 out of 81 second-year students passed the first License examination. The Temple Medical School, Patna, had 109 students on its rolls at the close of the session. At the final License examination 19 out of 28 candidates passed, and of 32 second-year students 25 passed the first examination. At the Cuttack Medical School the third-year class was attended by 16 students, 15 of whom passed and obtained licenses qualifying them for the post of Civil Hospital Assistant. Of the 13 students in the second-year class 11 passed the first License examination. Two native females attended this class, and are reported to have acquitted themselves very creditably. The first-year class consisted of 24 pupils, two of whom were females. The Director of Public Instruction reported that the medical education of women had made a considerable advance during the year.

Madras.

There were 292 students on the rolls of the Madras Medical College on the opening of the session on the 3rd October 1887, and three were admitted at the beginning of the summer session. Of these 119 were of the junior department, which was re-opened during the year by the abolition of the Rayapuram Auxiliary Medical School. Of the remaining 176, the new admissions numbered 32, the corresponding figures of the previous year being 215 and 41. The decrease was due to the gradual abolition

of the Civil Hospital Apprentice grade. Of the senior department 15 were studying for the M.B. and C.M. degrees, and 110, including four lady students for the L.M.S. degree. The results of the University examinations for 1888 were considered highly satisfactory, 39 per cent. having passed of the 97 candidates who appeared, against a percentage of 33 in the previous year. The failures occurred chiefly in the First L.M.S. examination, as many as 41 candidates having failed out of 55. The best results were obtained in the First and Second M.B. and C.M. examinations, the percentages of passes being 80 and 75 respectively.

Altogether there were 21 female students, or two less than in the previous year; still the attendance was 50 per cent. in excess of the number for 1885–86. "Slight "fluctuations," the Director of Public Instruction observes, "must of course be "expected, but considering the impetus which the scheme set on foot by Lady "Dufferin has given to female medical education throughout the country, and the "growing demand for female assistants in the wards for women in the hospitals in "the provinces, there is every reason to expect that, in spite of these fluctuations, the "number of female medical students will, in the long run, be on the increase."

The success of the female candidates was considered highly satisfactory. One lady student passed the first L.M.S. and another the Second M.B. and C.M. examination. Almost all the ex-students who have passed the requisite examination hold responsible positions as lady doctors in various parts of the country. Two Native Christian young ladies, who passed out in the previous year, were appointed as assistant surgeons under the Mysore Government.

The number of pupils attending the three medical schools of the Presidency, viz., the Madras Medical School, the Nellore Board Medical School, and H.R.H. the Prince of Wales' Medical School, Tanjore, was 197 against 204 in 1886–87. Of these 31 per cent. belonged to the poorer classes. At the Madras Medical School, which is attached to the Medical College, there were 148 pupils, 31 (including 17 females) in the second department, and 119 in the junior department. In the second department 6 students appeared for the primary examination, 5 of whom were females, and all passed, 2 females and the male students in the first class. Of 30 students who appeared for the final examination of the second department 27 passed, one being placed in the first class. The first and second years' students of the junior department were reported to be very backward in their studies; but out of the 24 students in their third year who were examined for certificates, 21 were successful.

Bombay.

The attendance at the Grant Medical College, Bombay, decreased from 276 at the close of the session of 1887, to 219 at that of 1888. The number of female students was 23, an increase of three on the previous year. The results of the University examination were satisfactory. For the first examination in medicine there were 65 candidates of whom 33 passed; for the second examination 42 candidates out of 76 passed; for the degree of L.M.S. there were 71 candidates, of whom 30 passed; and for the M.D. degree there was one candidate who passed. Three ladies from the non-matriculated class passed their final examination, and obtained certificates of qualification. It is reported that nine European women attended for instruction at the Obstetric Institution, three being the wives of soldiers. Five of them, including the three wives of soldiers, obtained certificates of qualification as midwives. One hospital assistant was examined and qualified for the grade of assistant surgeon; and 26 military pupils who had completed their course of study passed as qualified for the grade of assistant apothecary. "This class," it is reported, "is to be discontinued for "a time, and the College thus loses a good number of European students."

At the Government medical schools at Poona, Ahmedabad, and Hyderabad the number of pupils was 112 against 123 in the previous year. At the final examination 38 students and one midwife passed.

Punjab.

The number of scholars attending the Lahore Medical College and School at the end of 1887–88 was 195, of whom 61 (including two females) were in the college department, and 134 (including 14 females) were in the school department. The college students admitted during the year were required for the first time to pay a small fee. For the final examination of the Punjab University, 20 college students appeared, 15 of whom passed in all subjects, while at the junior examination in medicine 8 out of 16 candidates passed. In the school department, a knowledge of English, as shown by having passed the Anglo-Vernacular examination, was required for the first time from all candidates for the Government scholarships. This greatly reduced the number of applicants, who were only 74 for both the military and civil medical-pupil

classes, instead of 246 as in the previous year, and 29 of the candidates were admitted into these classes. At the final examination 26 out of 28 students who appeared passed, most of whom entered Government service, and 14 were sent to Burma.

North-Western Provinces and Oudh.

The number of pupils at the Agra Medical School rose from 146 in 1886–87, to 173 in 1887–88. Of these 51 were females, a number which the Principal considered had reached its normal average. The results of the examination were very satisfactory. In the male division the first or senior class contained 20 pupils, all of whom, except two private pupils, passed their final examination and received their diplomas. Of the 12 civil pupils who passed, several of them did so with distinction; two of them had been appointed on probation demonstrator of Anatomy and demonstrator of Materia Medica, respectively, at the school. In the second class of males there were 28 students. The class examination includes practical surgery, surgery, and practice of medicine. The results were reported as excellent, all but two having passed. The third class consists of students who have just returned after having spent a year at a Government dispensary or civil hospital, a system which has now been abolished. The fourth or junior class embraces the first-year students, of whom there were 53. The results of the sessional examination of this class was satisfactory. The progress made in the division for the instruction of female students was satisfactory. The first class consisted of 10 pupils; of whom only two passed, but with great credit; in the second class 11 passed out of 18, and in the junior class 12 out of 17 were successful. "These results," the Government observe, "are far from discouraging, and the "Lieut.-Governor entirely concurs with you (Inspector-General of Civil Hospitals) in "thinking that it would be unwise to make the standard of qualification for female "doctors lower than that demanded in the case of men. There are, as you remark, "many important questions to be decided before a final judgment can be passed on "the working of this branch of the institution; but substantial progress has been "made already, and there is the less reason for anxiety in the future. The initial "difficulty of attracting pupils has been apparently overcome, and there are now as "many on the rolls as it is desirable, in view of the immediate demand for the "services of that class of practitioners, to admit."

VII.—SANITATION.

Civil.

Bengal.

The Administrative Report of the Calcutta Municipal Corporation for 1887–88 is preceded by an interesting chapter giving the results of a comparison drawn between Calcutta as it was in 1876, when the present municipality was created, and as it was in 1888, which was the last year of its corporate existence. This will be found at p. 127, under the Abstract of the Report of the Calcutta Municipality.

During 1887–88, Rs. 3,33,416 were expended on sanitary improvements in the town of Calcutta against Rs. 2,03,244 in the previous year. Much attention was given to the reclamation and improvement of bustees. In five cases improvements were completed; three were approaching completion; in four improvements had been commenced; and projects for improving two were approved. Satisfactory progress was also made in tank-filling and in the erection of bathing platforms. At the end of the year there were 86 bathing platforms in working order, of which 17 had been put up during the year. The average daily supply of filtered water was increased from 9,116,847 gallons in 1886–87 to 10,330,525 gallons, and that of unfiltered water from 1,869,911 to 2,501,830 gallons. The drainage scheme of the town was virtually completed; the Hastings supplementary drainage scheme was completed; and that of Bagh Bazar was rapidly approaching completion. The total expenditure from capital on drainage during the year was Rs. 2,14,843. The length of public sewers constructed was 18,032 feet or 3·41 miles, bringing the total length on the 31st March 1888 up to 144½ miles. Besides this, 4,879 feet of bustee sewers were completed, making a total length at the end of the year of 5·21 miles. At the close of the year the total number of premises connected with the public sewers was 23,849.

Exclusive of the expenditure on the construction and maintenance of roads, amounting to Rs. 5,60,653, a sum of Rs. 12,97,383 was spent by the municipalities on sanitary work, which is an increase of Rs. 1,04,994 on the amount expended for this purpose in the previous year. The expenditure, however, varied very considerably in the different towns, and in some was very inadequate; in 25 cases nothing was spent on original sanitary works. It is satisfactory to learn that Rs. 1,39,041 was spent during the year by charitably-disposed persons on works of public utility, the main portion, Rs. 91,153, being expended on water-supply improvement. Neither in the towns nor districts were any great sanitary schemes begun. Satisfactory progress was made with the Bhagulpore waterworks. In Dinagepore a large scheme of town drainage was being carried out at the expense of the Maharajah of that place at an estimated cost of Rs. 60,000. On the Surpai drainage works in Midnapore district a sum of Rs. 29,692 was expended during the year, and upwards of Rs. 10,000 were spent on the erection of protective embankments in the same district. In many towns, conservancy was well attended to, but the only scheme undertaken of any extent was the construction of a tramway at Howrah, at an estimated cost of Rs. 30,000, for removing the night soil beyond municipal limits. During the year a number of towns and villages were inspected, but the results were very unfavourable. Out of 34 towns inspected, only four were found to be in a satisfactory condition. Much valuable information regarding sanitary defects was, however, collected, which it was hoped would prove of value to the sanitary boards when they are created, as directed by the Government of India in their Resolution of the 28th July 1887.

Madras.

During 1887–88, the Madras Municipality expended a sum of over 1¼ lakhs of rupees on the Black Town drainage scheme. A new sewer was undertaken and completed, and two outfall drains were successfully completed in the Broadway with the object of preventing water standing in this locality on the occasion of heavy rainfall, a nuisance that had been felt for many years. About 17 miles of drains of all sizes were constructed, making a total of over 56 miles. Many house drains were altered and repaired, and side drains were constructed in a large number of streets. The new water-supply scheme was under consideration. In order to raise funds for the works the Commissioners recommended the imposition of a tax on tobacco. The proposal has since been approved, and steps taken to legislate in the matter. The level of the water at the Red Hills lake having fallen during the hot weather, water was pumped into the channel for more than four months at a cost of Rs. 23,365.

The sanitary allotment of the Municipalities of Madras for 1887–88, amounted to Rs. 6,20,571, or 31·6 per cent of their estimated income. This, though proportionally lower than in the previous year (34·9) "may be accepted," the Sanitary Commissioner says, "as a fair contribution of the revenues on the whole towards sanitation." Of the total allotment, Rs. 3,86,862, or 62·3 per cent. was set apart for conservancy. No sanitary works of any magnitude were executed during the year, but many municipal councils were reported to be proceeding in a more systematic manner in regard to sanitary measures than hitherto, and had decided before incurring any further expenditure on drainage or water-supply to have plans first prepared and approved. Water-supply schemes were in preparation in Madura, Salem, Negapatam, and Kumbakonam.

In the local fund circles also no new works of importance were executed during the year. Still, what was done shows, the Sanitary Commissioner observes, that greater interest was being evinced by the authorities concerned in matters relating to sanitation. The total amount set apart for sanitation by the district boards amounted to Rs. 4,12,940, equal to 31·2 per cent. of available income.

During his tour of inspection, the Sanitary Commissioner pointed out to the several authorities any sanitary defects which he noticed, and the measures which should be taken to remedy them. He again suggested to Government that rewards should be given to the village officers who keep their towns and villages clean, and who were reported by inspecting officers as taking an interest in sanitation, and that those village heads whose villages were reported as dirty should be censured. This matter was to be referred to district boards for consideration.

Bombay.

In the municipality of Bombay progress was made with the Tansa water-supply project. A great deal of work was done in constructing the direct line, and in excavating for the foundation of the dam. The Government of India has recently sanctioned the raising of a loan by the municipal corporation of 25 lakhs of rupees on account of the Tansa scheme. The Vehar and Tulsi lakes overflowed early during the monsoon. Measures were taken to prevent a leakage of about $1\frac{1}{2}$ million gallons a day from the waste weir and one of the dams of the Tulsi Lake. New mains, exceeding 12 miles in length, were laid down during the year to meet the rapid expansion of the city. Additional inspectors were appointed for the detection of waste of water, and the results of their work showed a saving of $1\frac{3}{4}$ million gallons daily in addition to the waste of over half a million gallons prevented in 1886. But for this saving, it would not have been possible to supply the rapidly-increasing demand for water. A grant of over 11 lakhs for the Queen's Road and Girgaum pipe sewers and house connexions for sullage water was sanctioned by the Corporation, and good progress was made with the sewage works in other parts of the city. The construction of a small-pox hospital was sanctioned at a cost of Rs. 39,636, and the greater part of the building was completed during the year.

In the case of the other municipalities of the Presidency a sum of Rs. 7,36,449 was expended on conservancy during the year out of an income of Rs. 34,79,558. Besides minor improvements in water-supply, drainage, &c., several important sanitary works were executed or undertaken. Among them may be mentioned the scheme for supplying the city of Ahmedabad with pure water at a cost of 6 lakhs. A design for laying Tansa water pipes at Kalyan was under consideration. Works were being carried out for improving the water-supply of Ahmednagar at a cost of Rs. 12,000. At Talegaon Dabhada a tank costing Rs. 43,000 was built. A scheme for supplying the town of Dhulia with good water was approved. At Nasik plans and estimates had been submitted for supplying the town with drinking water. The waterworks of the city of Karachi were largely extended, and a drainage scheme was under consideration. At several other towns water-supply and drainage projects were either in progress or in contemplation.

The subject of sanitation was also well kept in view in the local fund circles, and, as far as funds permitted, improvements were effected, consisting chiefly in the provision of new tanks and wells and repairing old ones.

Punjab.

Several sanitary improvements were either completed or in progress in the Punjab during 1887. The Khalilpur bund in the Gurgaon district was making good progress. In the city of Delhi several underground drains were constructed. At Amritsar Rs. 41,652 were spent on the filling in of the city ditch and converting it into a pleasure ground. A drainage scheme for Gujranwala city, to cost Rs. 43,552, was sanctioned and taken in hand. A loan of Rs. 1,50,000 was sanctioned by the Government of

India for providing the city of Peshawar with waterworks. At Sialkot a scheme was in hand for supplying the city with pure water. At Rawalpindi the waterworks were completed, and plans and estimates for building up the main drain of the city with masonry through its entire length were under consideration. Excluding Dera Ghazi Khan, the returns for which had not been received, the municipalities of the province expended nearly 11 lakhs on sanitation. In his tour of inspection the Sanitary Commissioner was accompanied by members of the several municipal committees, to whom he pointed out the principal sanitary defects and the way in which they could be most easily remedied. "Members of municipal committees," he says, "as a rule, "take I fear, very little interest in sanitary matters. While accompanying me they "are always exceedingly polite, and promise to take steps forthwith to remedy the "sanitary defects pointed out, but on making inquiries afterwards regarding results, "I have usually discovered that comparatively little has been done, and unless a "certain amount of pressure is used, it will be a long time before the sanitary "condition of most of our towns is rendered even fairly satisfactory." The question of town and village sanitation was receiving the best attention of the local government in accordance with the instructions contained in the Resolution of the Government of India on the matter. But the whole subject is one in which rapid progress cannot be expected. "In municipalities, as in villages, there are the usual obstacles of apathy "and tradition, of tolerance of practices which the gentry in some European countries "have come to regard with dislike, and of want of faith in European doctrines of "sanitation."

North-Western Provinces and Oudh.

Sanitary work is reported to be steadily progressing in the North-Western Provinces and Oudh. Some of the more important works executed or undertaken during the year were as follows: In the town of Dehra Dun the waterworks were nearing completion. At Mussoorie a conservancy scheme for the removal of night soil has been completed at a cost of Rs. 23,363. At Saharanpur a large sum was expended in the completion of minor drains, and a scheme for effectually flushing them was under consideration. At Farukhabad a sum of Rs. 19,000 was expended on various sanitary improvements. The municipality of Moradabad spent Rs. 29,188 on sanitation, the chief work being the construction of a fine masonry drain from Deberia tank to the Ramganga. At Allahabad Rs. 78,603 were expended on sanitary improvements, and a sum of 12 lakhs of rupees was sanctioned for waterworks. At Ballia a drainage scheme was completed to facilitate the flow of water from the town during the rains. At Lucknow Rs. 67,422 were expended on original works. The great want of this town is a good water-supply, and until this has been furnished, the Sanitary Commissioner states, the public health will certainly continue, as at present, unsatisfactory. Another most important work was the drainage scheme known as the "Karwan Nadi Improvement," which was being carried out to relieve water-logged tracts in the Muttra and Agra districts at a cost of Rs. 86,000, of which Rs. 20,000 were given by landed proprietors. With a view to the improvement of the water-supply and drainage of the circles and towns in the province a supervising engineer for municipal water-supply has recently been appointed, and the municipalities of Benares, Allahabad, and Agra have already expressed their wish to make use of his services. The Sanitary Commissioner reports that all towns of 5,000 inhabitants or more had been visited by him or by his deputies, and a record taken of the insanitary conditions which had been pointed out to the inhabitants on the spot. The subject of water supply in these inspections, he says, receives special attention, but the apathy and ignorance of the people stand persistently in the way of efforts to effect improvement. With regard to drainage, he says, that to be effectual in reducing mortality in the province it must be more than local. It is the one efficient remedy for the reduction of the excessive mortality, and still more excessive sickness caused by diseases of malarial origin. He notices that domestic cleanliness is carefully attended to by the great majority of the people, and that it is in the houses of the wealthier inhabitants of towns that the most serious defects in domestic cleanliness exist.

Central Provinces.

No sanitary works of any great importance were carried out in the Central Provinces during 1887, but a good deal was done in improving the sanitary condition of the larger towns. Altogether 266 new wells were constructed and 26 old ones repaired. All the municipalities devoted some portion of their incomes to sanitary arrangements, principally conservancy, but the outlay on drainage and waterworks was not general, and in many towns was insufficient to secure any substantial benefit to the inhabitants.

The question of village sanitation received much attention during the year from the village headmen, and the special sanitary rules which at first had been made applicable to villages within a few miles radius of a few head-quarter stations were extended to all villages having over 50 inhabitants. "There is no doubt," the Chief Commissioner states, "that more attention is now paid to village cleanliness and to conservation of the "village water from impurities than ever before." The Government of India in their orders on the Sanitary Commissioner's report, observe that the progress of sanitation in the rural areas must necessarily be slow, but they trust that the question will receive a fresh impetus by the establishment of the Provincial Health Board under their recent Resolution on the application of sanitary principles to towns and villages in India.

Berar. No new sanitary works on a large scale were undertaken in the municipalities of Berar during 1887. Out of an estimated income of Rs. 1,78,315, Rs. 84,155, or 47·1 per cent. of total income, were expended in the seven municipalities for sanitary purposes; on conservancy alone 21·1 per cent. of the total income was expended. Proposals were made in the course of the year by the Akola Municipality for carrying out the scheme for supplying the town with water. The drainage of the town of Khamgaon was completed, and that of its suburbs taken in hand. As regards district expenditure, the only work of importance undertaken was a project to supply the civil station of Amraoti with water. The work is estimated to cost Rs. 48,431. The total district (non-municipal) expenditure on works of sanitary improvement was Rs. 1,03,390 as compared with Rs. 93,685 in the previous year. Of this sum, 29 per cent. was spent on conservancy, 22 per cent. on drainage, 18 per cent. on water supply, and 30 per cent. on other sanitary works. The sanitary inspection of towns and villages was steadily carried on and detailed reports were submitted as usual by the Sanitary Commissioner. An improvement in the sanitary condition of towns and villages in the Basim District was specially noticed.

Assam. The total income of the municipalities, unions, &c. in Assam in 1887 amounted to Rs. 1,47,229, and the proportion expended on sanitary works, exclusive of roads, was 30·43 per cent. On conservancy, Rs. 20,315 were spent. With the exception of the completion of the Gauhati water-supply scheme, which throughout the year was in full working order, no permanent improvement was effected. Details in connexion with a project for a water-supply for Sylhet Municipality were under consideration. In summarising the insanitary conditions that abound in the province, the Sanitary Commissioner notices the obstacles which stand in the way of reforming them. In accordance with a suggestion made by the Government of India, separate instructions have been issued by the Local Government regarding the prosecution of sanitary improvements in rural areas. Separate inquiries were also being made in regard to the sanitary improvement of towns with the view of ascertaining how far it was possible to carry out sanitary surveys in cases where such surveys might be shown to be desirable.

Lower Burma. Except the drainage works of Rangoon, for which a loan of 23 lakhs of rupees has been raised, and the reclamation of low-lying lands in the same town, no sanitary works of any magnitude were executed or undertaken in Lower Burma during 1887. It is stated that "in view of the urgent need for sites to house the growing popula-"tion of Rangoon, the Municipal Committee are earning a title to the gratitude of the "general public by the energy with which they are pushing on the work of reclama-"tion. The money now being spent is practically capital invested, as high rents will "be obtained for leases of sites on the reclaimed land."

Military.

Bengal. During 1877-88 a sum of Rs. 59,74,683 was spent on military works in the Bengal Presidency, being Rs. 3,74,945 less than the expenditure incurred in the preceding year. A large portion was devoted to the construction of barracks and subsidiary buildings at Quetta. Good work was also done in the construction and improvement of barracks at other stations; and at the various hill stations satisfactory progress was made in the construction of hut type barracks. The Chakrata water-supply scheme was approaching completion.

Madras. In the Madras Command the general sanitary condition of the barracks was reported to be satisfactory. The question of improving the water-supply of the garrison of Bangalore was receiving attention. The Ulsoor tank, which is the source of the

supply, was reported to be unsatisfactory and contaminated by filth from the adjoining bazaars. The matter having been brought to the notice of the municipal authorities measures were being taken for the better conservancy of the bazaars.

On military sanitary works in the Bombay Command a sum of Rs. 4,02,686 was expended during 1887. Of this amount Rs. 3,19,493 was laid out in Bombay and Colaba, chiefly on the construction of barracks for European troops, and of bungalows for officers on the Marine lines. Other work consisted in the provision of extra latrine accommodation and improvements in drainage and water supply. A scheme for supplying the station of Mhow with water from the Gambier Valley was in course of execution. Bombay.

India Office,
August 1889.

W. T. Bonson.

ABSTRACT

OF

SANITARY AND OTHER REPORTS

FOR

1887.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1887.

Sir B. Simpson, M.D.

European Troops.

The general health of the European Army of India was more satisfactory in 1887 than in the previous two years. The admission, daily sick, and death rates were all less. The unsettled state of Upper Burma, entailing extra reliefs and the transfer of sick to the Hill and other stations of India, had still the effect of raising the admission and death rates, but this indirect influence was probably less marked than in 1886.

Sickness and mortality in 1887.

Abstract of Statistics of European Troops in India for the last ten years 1878 *to* 1887, *and for the ten-year period* 1870–79.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	577,416	1,475	60	19·34	43	62
1878	56,475	1,651	68	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33‡	45
1883	55,525	1,336	63	10·88	33	44
1884	54,996	1,513	67	12·56	32	44
1885§	56,967	1,533	71	14·55	23	37
1886§	61,015	1,514	75	15·18	21	36
1887§	63,515	1,370	70	14·20	23	37

* Excluding troops serving in Afghanistan.
† Including troops in Afghanistan.
‡ Calculated on the strength obtained from Annual Returns.
§ Excluding troops on active service in Burma.

The ratio of deaths was 5·14 under the decennial average of 1870–79, and the admission-rate, 105 per 1,000 under the average for the same period. The fall in the admission-ratio, as compared with that of 1886, was due to a decrease in the number of admissions from ague, enteric fever, venereal disease, rheumatism, and neuralgia, and diarrhœa. There was a considerable increase in the total number admitted for cholera, and the death-rate from this cause was 2·00 as compared with ·49 in the previous year. The mortality from enteric fever declined from 5·08 to 3·76. The decrease in the sickness and mortality generally was confined to the armies of the Bengal and Madras Presidencies. There was less sickness, but increased mortality in the European Army of Bombay. The total loss of the army of India, from death and invaliding, was 37 per 1,000 of average strength, an increase of 1 per 1,000 on the ratio of 1886.

In the Bengal Presidency the admission-rate (1,426 per 1,000) was the lowest recorded during the past decade and less than the average of the decennial period, 1870–79, by 96 per 1,000 of average strength. The death-rate (14·83) was also less, although cholera was more prevalent than in the preceding year. There was a satisfactory decline in the mortality from enteric and remittent fevers, and the total number of deaths was 166 and 21 against 221 and 29 in 1886. Dysentery was also less fatal, and there were only 4 deaths from alcoholism, although the number of admissions from this cause was 699 against 645 admissions, with 9 deaths in 1866, and 327 admissions with 7 deaths in 1885. The total loss of the European Army of Bengal from death and invaliding was 34 per 1,000.

The admission (1,250 per 1,000), daily sick (77), and death-rate (12·96) of the European Army of Madras were all less than in 1886, and the death-rate was 4·73 under the decennial average of 1870–79. The indirect and unfavourable influence of active service in Upper Burma did not affect the British troops in the Madras Presidency to the same extent as in the previous year, when the death-rate was 16·46. As in Bengal, there was a decline in the mortality from enteric and remittent fevers and dysentery, and there was no death from diarrhœa. There was no death from alcoholism, although the sick-rate from this cause rose from 12·9 to 15·9. In contrast with the decline in the admission-rate for venereal in the Bengal and Bombay Presidencies, there was a slight progressive rise in the rate in the Madras Presidency. The total loss of the European Army of Madras from death and invaliding was 44 per 1,000 of average strength, an increase of 4 per 1,000 on the average annual ratio of 1886. In the Madras Presidency, 44 European soldiers were invalided for dysentery alone.

The admission-rate (1,292 per 1,000) among the troops of the Bombay Presidency was less by 241 per 1,000 than the average of the decennial period, 1870–79, and lower than in any year since 1878, with the exception of 1883. There was a slight rise in the death-rate, however (from 12·67 in 1866 to 13·23), owing to the greater prevalence of cholera, the death-rate from this cause alone being 2·50 against ·36 in 1886. A satisfactory decline in the death-rate from enteric fever is noticed. There was more sickness from alcoholism, but the mortality from this cause was the same as in the previous year. As in the Bengal Presidency, the progressive annual rise in the admission-rate for venereal disease received a decided check, and a fall in the admission-rate from this cause of 33 per 1,000 is shown. The admission-rate for all classes of fevers, including enteric, declined 101 per 1,000 of average strength. The total loss of the European Army of Bombay from death and invaliding was the same as in the previous year, namely, 41 per 1,000 of average strength.

The vital statistics of the troops serving in the Quetta District are incorporated with those of the Bengal Presidency. With a greater average strength, there has been a great and satisfactory diminution in sickness and mortality.

Period.	Average Strength.	Ratio per 1,000.						
		* Admissions.	Daily Sick.	Deaths from			Invaliding.	Total loss by death and invaliding.
				Cholera.	Other Causes.	Total.		
1884	1,441	2,056	83	27·07	41·63	68·70	23·30	92
1885	1,672	2,187	94	42·46	40·67	83·13	28·59	112
1886	1,752	2,442	73	0·57	19·41	19·98	11·41*	31
1887	1,932	1374	52	1·03	10·35	11·38	8·28*	20

* On weekly strength.

The principal causes of sickness were intermittent and simple continued fevers, venereal disease, respiratory diseases, abscess and ulcer and rheumatism and neuralgia. The admission-rate for fevers was in excess of the average for the Army of India, and for respiratory diseases more than double the general average for all India, while the rate for venereal disease was only 195·6 in comparison with the common average of 361·2. Two deaths from cholera were noted. Of the total number 22 deaths, 8 were due to fevers (including 2 to enteric), 5 to respiratory diseases, 2 to heat-stroke, 1 to dysentery, and 2 to peritonitis. The decline in the death-rate from 68·70 in 1884 and 83·13 in 1885 to 11·38 in 1887, though somewhat remarkable, is in a great measure due to the almost tota absence of cholera and other epidemics during the past two years, and to the improved sanitary and hygienic conditions of the garrison.

The chief causes of admission into hospital in the three Presidencies are shown in the following table :—

Admitted per of 1,000 *strength.*

Bengal.	1887.	1886.	1870-79.	Madras.	1887.	1886.	1870-79.	Bombay.	1887.	1886.	1870-79.
1. Malarial fevers	450	491	607	1. Venereal diseases	400	394	198	1. Malarial fevers*	373	472	660
2. Venereal diseases	356	394	209	2. Malarial fevers*	204	260	266	2. Venereal diseases	337	371	191
3. Injuries	121	120	91	3. Injuries	124	134	101	3. Injuries	112	124	95
4. Abscess and ulcer	81	91	82	4. Abscess and ulcer	84	95	108	4. Abscess and ulcer	66	79	97
5. Respiratory diseases†	67	62	84	5. Dysentery	62	71	77	5. Respiratory diseases†	46	62	64
6. Diarrhœa	43	58	62	6. Diarrhœa	38	60	65	6. Diarrhœa	42	46	61
7. Rheumatism and neuralgia.	38	41	62	7. Respiratory diseases†	47	50	57	7. Rheumatism and neuralgia.	33	38	49
8. Dysentery	24	28	33	8. Rheumatism and neuralgia.	31	39	46	8. Dysentery	22	23	28
9. Hepatitis	23	23	47	9. Hepatitis	37	36	67	9. Hepatitis	18	17	41
Total of the nine	1,203	1,308	1,277	Total of the nine	1,027	1,139	985	Total of the nine	1,049	1,232	1,286
Total from all causes	1,426	1,559	1,522	Total from all causes	1,250	1,380	1,764	Total from all causes	1,929	1,490	1,533

* Including simple continued fever. † Including tonsilitis and sore-throat.

The chief causes of sickness among the European troops composing the Army of India were malarial fevers with a total admission ratio of 391 against 445 in 1886. Venereal disease, however, was the principal cause of admission as in previous years in the Madras Presidency. The order of prevalence, as shown by the admission ratios, remained stationary in the Bengal and Bombay Presidencies, but in the Madras Presidency, diarrhœa takes the 7th place in consecutive order, while respiratory diseases take the 6th place and hepatitis should stand in the 8th place, while rheumatism and neuralgia show last with the lowest admission ratio of the year in this Presidency. Venereal disease, as noticed elsewhere, diminished in both the Bengal and Bombay Presidencies, but increased to a slight extent in Madras. Fevers were less prevalent in all three presidencies than in 1886. There was a marked diminution in the admission-rate for diarrhœa in Madras, with slight corresponding fall in the same rate for the other presidencies. Dysentery was less, while hepatitis was more, prevalent in all three presidencies.

Respiratory diseases proper were more prevalent in Bengal, while in the Madras and Bombay Presidencies there was a satisfactory decrease, most marked in Bombay in the admission-rate from such causes. There was a decrease in the admission-rate generally for tonsilitis and sore-throat, though in Bengal and Madras there was a slight rise in the rate which, on the other hand, fell in Bombay to the extent of reducing the general average.

The chief causes of mortality in the European Army of the three Presidencies are shown in the following table. The names of the diseases stand in the order of their fatality in the Army of India during the decennial period, from 1870–79 :—

Deaths from the Chief Diseases and from all Causes in the three Presidencies per 1,000 *of Strength.*

Deaths from	Bengal.					Madras.					Bombay.				
	1887.	1886.*	1885.*	1880-84.	1870-79.	1887.	1886.†	1885.†	1880-84.	1870-79.	1887.	1886.	1885.	1880-84.‡	1870-79.
Cholera	2·27	0·64	1·17	2·33	4·18	0·60	0·09	0·19	0·91	1·68	2·50	0·36	6·92	1·32	1·53
Hepatitis	1·31	1·26	0·88	1·28	2·04	3·16	2·50	1·04	1·66	3·16	0·80	1·18	0·70	1·10	1·71
Enteric fever	4·09	5·70	4·05	2·88	2·28	2·98	3·85	2·19	1·71	1·42	3·40	4·16	2·54	2·82	1·75
Apoplexy and heat-stroke	0·91	0·88	0·91	1·64	1·53	0·43	0·90	0·38	0·76	1·42	1·07	0·91	1·14	1·49	1·56
Dysentery	0·54	0·90	0·34	1·00	1·37	0·85	2·77	0·38	0·55	2·32	0·80	0·63	2·89	1·54	0·98
Remittent and simple continued fevers.	0·64	0·83	0·57	0·91	1·74*	0·51	0·89	0·19	0·21	0·62†	0·72	0·27	1·49	1·36	1·14*
Total of the six	9·76	10·21	7·92	10·04	13·14	8·53	11·00	4·37	5·80	10·62	9·29	7·51	15·68	9·63	8·67
All causes	14·83	15·52	13·16	16·17	21·00	12·96	16·46	9·13	10·02	17·69	13·23	12·67	23·82	16·92	15·27

* Excluding troops on active service in Burma. † Including deaths from intermittent fever. ‡ Approximate averages.

Enteric fever was the chief cause of mortality in the Bengal and Bombay Presidencies, and hepatitis the chief cause in the Madras Presidency. The mortality from enteric fever declined in all three presidencies. The death-rate from hepatitis rose to the average of the decennial period in the Madras Presidency. There was a considerable increase in the mortality ratio from cholera in all three presidencies. The mortality from apoplexy and heat-stroke was higher in the Bengal and Bombay, and lower in the Madras Presidency, in which the death ratio from dysentery fell from 2·77 in 1886 to ·85 in 1887. The total average mortality from the six chief causes was less in Bengal and Madras, and greater in Bombay than in 1886. The decline in mortality in Bengal was due to the lessened fatality from enteric fever, in Madras to the improvement in the death-rate from dysentery, and the rise in Bombay to the greater prevalence and increased death-rate from cholera. The principal feature in the ratios of mortality is the decrease in all three presidencies from enteric fever, the increase in the cholera-ratio, and the exceptional rise in the mortality from hepatitis and abscess of the liver in the Madras Presidency.

The following statement shows the admission and death-rates for a series of years in the several geographical groups of stations occupied by the European Army of Bengal:—

Period.	Ratio per 1,000 of strength.													
	Bengal Proper.		Gangetic Provinces and Oudh.		Meerut and Rohilkund.		Agra and Central India.		Punjab.		Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860–79†	1,566	22·00	1,512	24·32	1,518	22·46	1,850	28·45	1,794	22.98	1,056	13·50	1,638	25·49
1860–69	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	1,069	14·78	1,755	29·98
1870–79	1,311	14·43	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·23	1,522‡	21·00‡
1880*	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,253	20·75	1,813	27·73
1881*	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05
1882	1,187	11·19	1,699	22·61	1,613	8·86	1,891	10·51	1,796	12·12	975	8·65	1,579	13·17
1883	1,011	9·10	1,474	17·04	1,528	10·56	1,497	14·27	1,601	9·47	1,454	6·33	1,463	11·21
1884	1,195	10·07	1,381	14·72	2,028	17·01	1,874	15·53	1,992	9·75	1,201	5·91	1,662	11·68
1885	1,449	13·09	1,539	15·23	2,463	18·00	1,687	10·93	1,566	12·67	1,395	9·50	1,661	13·16
1886	1,675	15·46	1,630	17·09	2,902	16·68	1,526	15·91	1,442	16·64	1,219	10·27	1,559	15·52
1887	1,617	14·17	1,437	19·01	1,750	14·31	1,696	20·03	1,375	13·63	1,112	12·42	1,426	14·83

* Excluding troops in Afghanistan and on the march. † Approximate averages.
‡ Including troops in Afghanistan and on the march.

The Agra and Central India group returned the highest death-rate. Intermittent and continued fevers were much more prevalent in this group than in the previous year, and the admission-rate was 698·9 against 470·6 in 1886. The mortality ratio from cholera was 5·46 in comparison with 1·18, and the death-rate from apoplexy and heat-stroke 1·21, while in the previous year no death occurred from the latter causes. Excluding hill stations, the Punjab group was the healthiest, and both the admission and death rates were under the average for the Bengal Presidency. Bengal proper comes next with a death-rate of 14·17 and the Meerut and Rohilkund group with 14·31, also under the average of the Presidency. The highest admission-rate, 724·8, was for intermittent and continued fevers in the Meerut and Rohilkund group against 285·1—the lowest in the Gangetic provinces group. Venereal disease was most conspicuous in the stations of Bengal proper and the admission-rate was 449·9 against 323·1 in the Punjab. The death-rate from cholera was 5·46 in the Agra and Central India group, while in the stations of the endemic area, there was only one admission and no death from the disease. Hill stations returned the highest ratio of mortality, 6·21, from enteric fever. In Bengal proper there was no death from enteric, remittent or simple continued fever, in contrast with the high death ratios of the other groups. On the other hand, the death-rate from hepatitis in Bengal proper was more than double the same rate in any other group, and the ratio of the next chief cause of mortality in lower Bengal, namely, dysentery was five times that of any other individual group, but such high relative ratios of mortality from individual diseases are far from constant.

In only three groups were the death-rates in excess of the previous year, and in all the groups the ratios of mortality were considerably less than the decennial average. The rise in the death-rate of the Gangetic provinces and Oudh group was due to the greater prevalence of cholera, and an increase in the mortality from enteric fever and from apoplexy and heat-stroke. In the Agra and Central India group the increased mortality was due to cholera, apoplexy, and heat-stroke. Hill stations record the

lowest mortality, which, however, was higher than in 1886. Enteric fever, as elsewhere, was the principal cause of mortality, while cholera, which was altogether absent from Hill stations in the previous year, appeared in two stations (Ranikhet and Chaubattia) of the North-Western Provinces. The highest ratio of mortality, 6·39 from enteric fever, was in the Gangetic provinces and Oudh group, closely followed by the Hill station group, with a death-rate of 6·21. The Punjab group returned the lowest ratio, 3·20, barring Bengal proper, in which no death occurred from this cause or from cholera.

Of the large stations with a strength of over 1,000, the following returned a death-rate over 15 per 1,000, namely:—

	Average Strength.	Mortality per 1,000 of average Strength.
Fort William	1,090	18·35
Allahabad	1,051	26·64
Meerut	2,234	17·01
Peshawar	1,638	18·32

Ferozepore, with a strength of 972 European troops, recorded the low mortality of 6·17 per 1,000 of average strength. The highest ratios of mortality occurred in the Forts of Chunar and Lahore, namely 53·33 and 44·64, with the relatively very small garrisons of average strength, 75 and 112 respectively. The stations of Nowgong, Benares, Attock, Amritsar, Jhansi, and Meean Meer returned mortality ratios ranging from 34·21 in Nowgong to 21·32 in Meean Meer.

A large proportion of the troops composing the European Army of Bengal was located at Hill stations during the year. The average strength of troops occupying Hill stations ranged from 583 in January to 10,754 in June. The following statement shows the number of European troops actually located in the Hills in the Bengal Presidency during the summer of 1887.

Nature of Accommodation.	Men.	Women.	Children.
Hills Depôts	2,389	314	732
Regular Hill Stations	4,842	237	437
Temporary Locations	6,470	144	279
Mussoorie Summer Home	—	—	60
Total	13,701	695	1,508

Enteric fever, cholera, and hepatitis were the chief causes of mortality at Hill stations; and venereal disease, fevers, injuries, respiratory diseases, abscess and ulcer, rheumatism and neuralgia, and diarrhœa the chief causes of sickness. The rise in the death-rate of the year was due to an outbreak of cholera at Ranikhet, and in a minor degree to the greater mortality from enteric fever. Of the total number of deaths, 108, at Hill stations and at Hill convalescent depôts, 44 were returned as enteric fever, 10 cholera, 10 hepatitis, 8 respiratory diseases, and 8 as phthisis.

There was less sickness among the European troops serving in the Rajputana, Malwa, Sind, and Aden group, but the mortality was greater. Fevers were less prevalent and the number of admissions for venereal disease was 1,630 against 2,388, and the general admission-rate was 1413·4 against 1636·7 in 1886. The death-rate, however, was 17·10 against 14·94, and the increase was chiefly due to cholera. There was the same number of deaths from heat-stroke as in the previous year. The death-rate from enteric fever declined from 5·83 to 3·92, but there were 4 deaths from remittent fever and one from simple continued fever against none from such causes in last year's record. Ahmedabad, Neemuch, and Indore returned the highest sick-rate, while the greatest mortality occurred at Neemuch and Indore, the respective death ratios reaching the large aggregate of 58·94 and 55·56. Of the 30 deaths at Neemuch, 17 were from cholera, 2 each from remittent fever, dysentery, and hepatitis. The Indore garrison with a strength of 108 had 6 deaths. In the large garrison of Mhow there was a total of 23 deaths, of which 13 were caused by enteric fever and 5 by cholera. The garrison of Kurrachee, with the average strength of 968, returned 10 deaths,

6 of which were due to enteric fever, 2 to dysentery, and 2 to phthisis; and Aden with the average strength of 850, recorded also 10 deaths, 5 from heat-stroke 2 from dysentery, and 1 each from remittent fever, alcoholism, and accidental drowning.

There was a decrease in the sick-rate, but a slight increase in the death-rate among troops serving in the Deccan and in Nagpur during the year. The admission-rate was 1183·5 against 1279·4, and the death-rate 10·88 against 10·52 in 1886. There was a death-rate from cholera of 1·10, or a total of 10 deaths from this cause. The ratio of mortality from enteric fever declined from 4·49 in the previous year to 3·73. The other chief cause of mortality was hepatitis, with a death-rate of 1·65. Ahmednagar recorded the highest average mortality and a total of 14 deaths, including 7 from enteric fever, 2 from cholera, and 2 from phthisis. Secunderabad, with an average strength of 2,817, returned 34 deaths—12·07 per 1,000 of average strength, including 16 from enteric fever, 8 from hepatitis, and 4 from cholera. The Poona garrison was the healthiest of the group, with a ratio of mortality of 7·19 per 1,000 of average strength, the chief cause of death being enteric fever. Bombay, with an average strength of 758, had 7 deaths, including 1 from enteric fever, 2 from intermittent fever, and 1 from sun-stroke.

The decrease in sickness in Southern India was due to the diminished prevalence of fever of the simple continued type, of dysentery and diarrhœa, and to a considerable fall in the number of admissions for venereal diseases. The death-rate was slightly higher. There was a total of 49 deaths, including 16 from enteric fever, 7 from hepatitis, 4 from respiratory diseases, and 4 from dysentery. Enteric fever was more prevalent than in the previous year, and there was an increase in the mortality from this cause, while the death-rates from dysentery and hepatitis diminished to some extent. There was only 1 death-rate from heat-stroke, against 3 in the previous year. Cannanore shows the highest admission-rate, and Malliapoorum the highest ratio of mortality. There were 5 deaths at the latter station, all from different causes. Of the 13 deaths in the garrisons of Madras and Palaveram, 4 were caused by abscess of liver, 3 by dysentery, and 1 by sun-stroke. Bangalore, with an average strength of 2,077, returned 19 deaths, of which 11 were due to enteric fever, 3 to accident, and 1 to cholera.

Both sickness and mortality in the regular stations of Burma and Pegu were greatly less than in 1886. The admission-rate was 1467·7 against 1905·2, and the death-rate 11·61 against 34·73. With an average strength of 1,809 in these reputedly unhealthy stations, there was a total of 21 deaths only, including 4 from abscess of liver, 2 each from dysentery and remittent fever, 1 from cholera, 1 from enteric fever, and 5 from violence out of hospital, including 2 from accidental drowning. Port Blair, with an average strength of 132 Europeans, returned 1 death from abscess of the liver. Toungoo, with an average garrison of 442, had 2 deaths, 1 from remittent fever, and 1 from Bright's disease, while Rangoon, with a strength of 915, recorded 12, 4 from violence, 2 from hepatitis, 6 from all other causes; and Thayetmyo 6 deaths, including 1 from cholera and 1 from heat-stroke. The death-rate from climatic causes was exceptionally low.

There was a total absence of enteric fever in the Hill stations of Madras and Bombay in 1887, and fevers of remittent and continued type were less prevalent. The death-rate rose from 14·68 to 15·62, owing to increased mortality from hepatitis and abscess of liver. Mount Aboo, with an average strength of 95, had three deaths, one each from remittent fever, hepatitis, anæmia, and debility. The chief causes of admission were intermittent fever and venereal. Purandhar and Taragarh, each returned one death. The chief cause of sickness at Wellington was venereal disease, and of the 4 deaths recorded, 3 were from abscess of the liver, and 1 from rupture of bladder. Wellington depôt returned 6 deaths, including 3 from hepatitis and 1 from accident out of hospital. The chief causes of sickness were intermittent fever and venereal disease, of which the admission-ratio was 435·4, which indicates excessive sickness from this cause.

The returns for Upper Burma for 1886 were altogether incomplete, and no comparison can be drawn regarding the sickness and mortality of that with the past year. The average strength of the European troops in 1887 was 4,319, and the total number of deaths which occurred in the stations or *en route* to and from Upper Burma was 174, of which 68 were from fevers, 27 from dysentery, 19 from hepatitis, 16 from violent deaths out of hospital, including 1 only from gunshot in action. There was 1 death from cholera, and 1 from small-pox. The chief causes of sickness were intermittent

fever and venereal disease, and next in order dysentery, abscess and ulcer, simple continued fever, diarrhœa, wounds and accidents. There were 16 deaths from apoplexy and heat-stroke, and of the deaths by violence out of hospital, 13 were due to accidental drowning and 1 to lightning-stroke. The ratio of mortality was 40·29 per 1,000 of average strength against 14·20, the ratio for the European troops composing the Army of India. At least 20 per cent. of the mortality was due to direct exposure and accident, and the total mortality compares very favourably with that of troops on active service in Afghanistan in 1878 to 1880.

Cholera prevailed to a greater extent in the Army of India than in 1886. There were 183 admissions and 127 deaths, against 41 cases and 30 deaths; 69 per cent. of those admitted died, but it is doubtful if the percentage of deaths to admissions be correct, as in many stations recording admissions and deaths the same number was returned under each head. It may be rightly inferred that some forms of epidemic and choleraic diarrhœa are entered as simple diarrhœa, as the extreme fatality of 100 per cent. rarely, if ever, occurs, except in individual and sporadic seizures. All the cases admitted in Dinapore, Benares, Fyzabad, Cawnpore, Jhansi, Nowgong, Jubbulpore, Quetta, Naini Tal, Ahmednagar, Poona, Kirkee, and Secunderabad died. The average percentage of deaths to cases treated in the decennial period from 1870–79 was 69·11, and the percentage noted, namely 100, would seem to indicate an increasing virulence, which probably is not the case. Cholera.

There was a total of 92 deaths from cholera in the Bengal Army, against 25 in the previous year. The greatest number of deaths occurred in the Punjab, but the ratio of mortality was highest in the Central India group of stations. There were 10 deaths at Hill stations, 7 at Ranikhet, 2 at Naini Tal, and 1 at Chaubattia; 10 deaths among troops marching in the Punjab, and 1 among troops marching in Bengal; and, in all, 21 stations returned deaths from the disease. Each group of stations recorded cases showing how widely distributed the disease was, though the ratio of mortality only reached 2·27 against 4·18 and 9·24 in the decennial periods, from 1870–79 and 1860–69, respectively. There were admissions from cholera in each geographical group and with the exception of Bengal proper, each group recorded deaths, the highest ratio of mortality occurring in Agra and Central India. All the ratios of mortality were under the decennial averages, with the exception of that of the Agra and Central India group, in which the ratio was 2·24 in excess of the decennial average of 1870–79. The deaths per cent. of treated in this group were 90·00 against 72·38, and 60·02 in the decennial periods from 1870–79 and 1860–69. The mortality from cholera among the general population of Central India was greater than in any year since 1875, and this may account for the high average mortality among European troops stationed within the area of comparatively excessive incidence of the disease in Bengal. On the other hand, there were more deaths from cholera among the general population of the North-West Provinces and Oudh than has as yet been recorded in any one year; and in Lower Bengal, judging from the record of mortality, the disease reached a maximum of prevalence without affecting the European troops in any degree approximate to its incidence amongst the general population.

Eight seizures, with seven deaths, occurred in the Madras Army. There were 4 deaths in the garrison of Secunderabad, 1 at Kamptee, and 1 at Bellary. One admission, with one death, occurred at Thayetmyo in Lower Burma, included in the Madras Command. The death-rate from this cause was ·60 against 1·68 in the decennial period from 1870–79.

The cholera mortality in the Bombay Army rose from ·36 in the previous year to 2·50. There were in all 28 deaths, the greatest number of deaths being returned from Neemuch and Mhow, 17 and 5, respectively. Two deaths from the disease were noted at Kirkee, 1 at Poona, and 2 at Ahmednagar, and the garrison of Indore recorded one death.

Small-pox was more prevalent, and there were 39 admissions and 2 deaths in Bengal against 19 admissions and 1 death in 1886. Both deaths occurred at Agra. The disease prevailed most in Punjab stations, and there were 4 admissions from small-pox at Hill stations. There was one admission and no death in the whole of the Bombay Presidency. The case was returned from Ahmedabad. The European Army of Madras had a total immunity from the disease. Small-pox.

There was a considerable decrease in the admission ratio for ague, both in the Bengal and Bombay Presidency, viz., from 382 and 358 per 1,000, respectively, in 1886 to 356 and 269 in 1887. The Madras ratio (136 per 1,000), remained all but stationary. There was a slight increase in the death-rate, the Bombay Army having returned 2 deaths from this cause against none in the previous year.

The annual admission-rate for remittent and simple continued fevers declined in all three presidencies, and the death-rate likewise in Bengal and Madras. Simple continued fever is variously returned, either as intermittent or simple continued, by different medical officers. Some officers scarcely returned any cases of intermittent fever from certain stations as heretofore, but classed all the minor fevers as simple continued fevers.

Enteric fever is the most fatal of all the diseases to which the European soldier in India is liable. The ratio of mortality from this cause is much higher than that from cholera. The bacteriologist has indicated its origin in one of the many micro-organisms, which, it is assumed, assail vital function and activity, and displace or consume in the evolution of what they are the highest and most perfect of all created living structures. The act or process by which the minutest and lowliest of created organisms destroy the highest is as yet unknown. Reference is often made to presumed zymotic poisons resulting from the evolution of such organisms, just as certain ptomaines are the result of the saprophytic action of Bacterium termo and its congeners in multitudes, which follow each other in rapid succession in the work of setting free the elements of dead organic matter, and resolving into its inorganic constituents what but a little while before was living tissue. All at present known is that certain micro-organisms in their evolution in the human body disturb functional activity, lessen vital power, and may ultimately annihilate motion and still all operation and faculty of life. That such is the case has become a positive, and not merely a speculative, reality in medical science. But whether the "Typhusbacillen" of Gaffky are pathognomonic of abdominal typhus, or Kock's comma bacillus the cause or pathognomonic of cholera may remain matters for further elucidation. There is no room for doubt, however, that some of the minute colonies of micro-organisms of the dust of the atmosphere, and certain microbes of the incubation chamber of the scientist are essentially the deadliest foes of human kind. Enteric fever may owe its origin to a micro-organism or certain organisms may be pathognomic of the disease, but the exact determination and demonstration of such organisms are still problems unsolved. Practical sanitarians still maintain the view that enteric fever has its origin in pythogenic conditions, and that the removal of sanitary blots lessens the incidence and tends to eradicate the disease. All action taken in England and elsewhere with a view to remedy sanitary defects generally has had this effect; but no single insanitary condition or combination of sanitary evils can be definitely represented as the exciting cause of enteric fever.

The doubt so long expressed as to the exact nature of the disease still named by some "Bengal Remittent Fever," has been resolved not only by a consensus of medical opinion in India, but by the exact determination of facts and the recorded statistics of the past decade. The enteric fever of England and of India is one and the same disease. It is the most fatal, as stated, of all the diseases to which the British soldier in India is liable, and it occurs everywhere throughout India, from the Eastern to the Western Frontiers, on the hills and mountains as on the plains, and there is no station or cantonment in India which can be said to be exempt from the disease. Natives, as well as Europeans, are liable to attack, and women and children of certain age, are probably as subject to the disease as the youth of the European Army. In mild cases enteric fever runs a remarkably uniform course which simulates mild remittent, intermittent, and simple continued fevers to such a degree that the exact nature and diagnosis of the disease was not generally understood till quite recently. The insanitary condition of all Indian stations in their surroundings is so pronounced that if contamination of water and of food-supply, defective sewerage and drainage, accumulation of excreta and reeking effluvia of all kinds be individually, or in combination exciting causes as generally believed of enteric fever, it is not surprising that the disease should be so widespread and more fatal than all other diseases under the favouring conditions which, as stated, surround every station and cantonment of the Indian Empire.

The following table shows the admission and death rates for enteric, intermittent, remittent, and simple continued fevers for a series of eight years :—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.	Enteric fever.	Ague, remittent and simple continued fevers.	Total.
1870-79*	5·3	607·3	612·6	2·28	1·74	4·02	3·9	266·5	270·4	1·42	0·62	2·04	3·1	659·9	663·0	1·75	1·14	2·89
1880†	8·7	809·6	818·3	3·07	2·66	5·73	2·6	450·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881†	6·3	763·9	770·2	2·62	0·81	3·43	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8	2·83	0·91	3·74
1882	7·3	600·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	558·5	563·6	1·90	0·81	2·71
1883	8·1	486·4	494·5	2·52	0·44	2·96	8·6	128·4	137·0	2·86	0·28	3·14	5·7	436·4	442·1	1·55	0·73	2·28
1884	12·6	682·8	695·4	3·31	0·36	3·67	11·4	166·0	177·4	1·67	—	1·67	9·1	504·4	513·5	2·05	2·14	4·19
1885	14·0	611·0	625·0	4·05	0·60	4·65	6·4	149·4	155·8	2·19	0·19	2·38	7·3	577·5	584·8	2·54	1·49	4·03
1886	21·6	490·5	512·1	5·70	0·99	6·69	11·9	259·8	274·7	3·85	0·89	4·74	12·3	472·2	484·5	4·16	0·27	4·43
1887	13·4	449·7	463·1	4·09	0·76	4·85	11·5	203·6	215·1	2·98	0·51	3·49	11·3	372·6	383·9	3·40	0·90	4·30

* Including troops on active service and on the march. † Excluding troops in Afghanistan.

There was a fall in both the admission and death-rates from enteric fever in all three presidencies. The decrease in the death-rate was most marked in Bengal, corresponding with a very great diminution in the admission-rate in the same Presidency. The ratio of admissions per mille for intermittent, remittent, and simple continued fevers was also less in all three presidencies, and the death-rate from such causes lower in the Bengal and Madras, whereas in Bombay the death-rate rose from ·27 to ·90. The combined mortality from enteric and the other fevers noted was less in all three presidencies, and the total in Bengal was 4·85 against 6·69 in 1886. All the enteric fever ratios are higher than the decennial averages, but prior to 1880, enteric fever was undoubtedly very frequently returned under "Other fevers," and the progressive increase of late years in the admission and death ratios is simply due to greater accuracy in diagnosis. It is satisfactory to note, however, that this progressive increase has received a decided check in the year under review. The conclusion is, that the mortality from enteric fever reached a maximum in 1886, and that under ordinary circumstances the high death-rate of that year is not likely to be much exceeded in the future.

The following table is introduced to show the fluctuations in the death-rates from enteric and the other fevers during the years 1872–87 :—

Presidencies.	Fevers.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.	1883.	1884.	1885.	1886.	1887.
Bengal	Intermittent, remittent, and simple continued.	1·78	1·39	1·10	1·18	0·71	0·66	1·56	2·63*	2·66*	0·81	0·77	0·44	0·36	0·60	0·99	·76
	Enteric	1·62	1·53	2·01	1·59	1·75	1·55	4·69	3·86*	3·07*	2·62	2·90	2·52	3·31	4·05	5·70	4·09
	Total	3·40	2·92	3·11	2·77	2·46	2·21	6·25	6·49*	5·73*	3·43	3·67	2·96	3·67	4·65	6·69	4·85
Madras	Intermittent, remittent, and simple continued.	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27	0·28	—	0·19	0·89	·51
	Enteric	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86	1·67	2·19	3·85	2·98
	Total	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14	1·67	2·38	4·74	3·49
Bombay	Intermittent, remittent, and simple continued.	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81	0·73	2·14	1·49	0·27	0·90
	Enteric	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·98	5·76	2·83	1·90	1·55	2·05	2·54	4·16	3·40
	Total	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·71	2·28	4·19	4·03	4·43	4·30

* Excluding troops in Afghanistan.

The rise in the death-rate from enteric fever in Bengal, from 1·62 in 1872, to 5·70 in 1886, is very marked and corresponds with the greater accuracy of the differential diagnosis of the fevers of India by the officers of the Medical Staff. Besides accuracy in diagnosis and differentiation of a certain class of diseases, the increase in enteric fever, as it appears in statistical returns, is in part due to the greater incidence of the

disease among European troops owing to the larger proportion of youths now comprising the bulk of the effective force in India. This fact, as stated, probably accounts for the rise in the general death-rate from fevers, owing to the liability of the young soldier to contract enteric fever during the first years of his service in India. The decline in the death-rate from other fevers is accounted for by the transfer of certain doubtful cases of "other fevers" to the no longer doubtful head "enteric." The rise in the death-rate from enteric fever, and the decline in the same rate from other fevers, are illustrated in the following table:—

	During 1870–79.			During 1880–85.			During 1886.			During 1887.		
	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.
Army of India	2·03	1·42	3·45	2·89	1·02	3·91	5·08	0·84	5·92	3·76	·74	4·50
„ Bengal	2·28	1·74	4·02	3·18	1·08	4·26	5·70	0·99	6·69	4·09	·76	4·85
„ Madras	1·42	0·62	2·04	1·79	0·22	2·01	3·85	0·89	4·74	2·98	·51	3·49
„ Bombay	1·75	1·14	2·89	2·77	1·55	4·32	4·16	0·27	4·43	3·40	·90	4·30

* Intermittent, remittent, and simple continued fevers.

The following statement indicates the relationship between enteric fever and age in the European Army of the three presidencies:—

Year	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1877	2·45	44·2	1·55	27·9	0·99	17·8
1878	6·04	53·0	3·55	31·1	1·04	9·1
1879	6·17	54·1	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14
1883	4·34	66·36	1·50	22·94	0·70	10·70
1884	4·61	62·05	1·83	24·63	—	—
1885	5·16	61·06	2·30	27·22	0·74	8·76
1886	7·44	63·05	3·08	26·10	1·02	8·65
1887	5·37	54·24	2·63	26·57	0·68	6·87

The ratio of liability to enteric fever at different ages remained more or less constant for some years, and youth is relatively one of the predisposing causes of the disease.

The mortality from enteric fever and the ratio of liability at different periods of residence in India are illustrated in the statements which follow:—

Statement showing the proportion of men who have served in India two, five, and seven years from 1871–87.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1880	33·4	65·4	77·2
1872	33·7	66·7	80·0	1881	38·9	70·4	81·1
1873	31·7	65·5	79·6	1882	33·1	71·9	82·9
1874	25·9	64·3	79·8	1883	32·3	74·7	85·5
1875	26·1	60·1	81·0	1884	36·2	75·0	86·2
1876	25·5	57·6	75·1	1885	36·6	73·0	86·8
1877	25·2	56·2	72·6	1886	38·8	74·7	86·8
1878	28·9	59·8	73·0	1887	35·3	72·7	86·1
1879	32·1	60·9	72·6				

Statement showing the death-ratios of the European Army from Enteric Fever, at different periods of residence in India, together with Ratios of Liability to it, for 1877–87.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at Different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability
1877	3·31	59·5	1·35	24·2	0·90	16·1
1878	7·90	63·4	2·64	21·2	1·38	11·0
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·08	75·98	1·78	14·90	0·47	3·93
1881	4·55	60·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44
1883	4·98	70·34	1·55	21·89	0·55	7·77
1884	5·47	70·04	1·55	19·85	0·46	5·89
1885	6·55	68·87	1·93	20·29	0·38	4·00
1886	8·63	64·12	3·31	24·59	1·12	8·32
1887	7·13	66·57	2·37	22·13	0·82	7·66

The percentage of liability to enteric fever during the first and second year's residence is greater than the total of all the other periods. The high average mortality is shown to be due to the large proportion of young men under 25 comprising the bulk of the European Army of India, and the short system of service which permits of an excessive number of youths being passed into service in a sub-tropical climate at a period of life when they are most susceptible to particular diseases, and especially to enteric fever. The high average death-rate from enteric fever among the troops in India compared with the death-rate from the same cause among troops serving in the United Kingdom, points to specific and predisposing causes at work in India, which do not obtain to the same or nearly the same extent in England. The average mortality from the disease among troops in India is about ten times greater than at home.

The cause, or the exciting or predisposing causes, of enteric fever are no nearer elucidation than in former years, and the views of medical officers regarding the nature and etiology of the disease have undergone no definite change or modification.

The admission and death-rates from fevers in the Quetta district for a series of years are thus tabulated:—

	*1882.		*1883.		1884.		1885.		1886.		1887.	
	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1,000.	Death-rate per 1,000.
Enteric fever	12·9	3·23	11·6	4·83	29·6	9·27	9·5	2·71	5·6	3·77	1·6	1·03
Intermittent fever	265·9	—	252·4	—	484·7	—	1,277·4	—	1,602·6	—	531·6	—
Remittent and continued fevers	74·3	—	18·4	—	282·7	5·56	62·9	4·74	89·1	4·39	123·1	3·11
Total	353·1	3·23	282·4	4·83	797·0	14·83	1,349·8	7·45	1,697·3	8·16	656·3	4·14

* Including Gulistan for a short period.

It will be seen that the admission-rate has diminished by over 50 per cent., and the death-rate by nearly 50 per cent. as compared with the previous year, and the death-rate is in marked contrast with the high rates of the three preceding years. The high admission and death-rates under the head "Remittent and continued fevers" were evidently due to indefinite diagnosis, as some of the deaths recorded under remittent fever bear a marked resemblance to cases of enteric fever. One case is stated to have "had high temperature with congested bowels, with diarrhœa,

" throughout the attack. Some ulceration was found near the ilio-cœcal valve." Another of the fatal cases of remittent fever " was first attacked as if with ague, but " remittent fever supervened, and he died exhausted by diarrhœa after some time. " Congestion of the intestinal track was also evident in this case." A death, ascribed to simple continued fever of 26 days' duration and ending in collapse, is imperfectly recorded.

Bowel complaints.

Dysentery and diarrhœa were less prevalent in all three presidencies, and the death-rate from both causes (0·65 and 0·06 per 1,000) was less than in the previous year. The admission and death-rates for dysentery were, as usual, higher in the Madras than in the other presidencies. Diarrhœa, instead of being more as in the previous year, was less prevalent in Madras than in Bengal or Bombay, and there was no death from this cause throughout the Madras Army. Both the admission and death ratios for both complaints in the Army of India, and the armies of the three presidencies, were all below the decennial average. The admission-rate for diarrhœa in the Bengal and Madras Presidencies was not only less than the decennial average, but also less than that recorded in any year since and including 1880. Dysentery was much less fatal in Madras than in the previous year, and the ratio of mortality from this cause was 0·85 as compared with 2·32, the decennial average.

Heat-stroke.

There were 139 admissions with 48 deaths from heat-stroke, and 8 admissions with 6 deaths from apoplexy, including cerebral congestion, in the Army of India. Of the deaths from heat-stroke, 32 occurred in the Army of Bengal, 5 in Madras, and 11 in Bombay; and of fatal cases of apoplexy, 5 were in Bengal and 1 in Bombay.

Hepatitis.

There was an increase in the admission and death-rates from hepatitis, which were 25 and 1·56 per 1,000 respectively, in all the three presidencies during the year, and the death-rate in the Madras Presidency reached the decennial average of 3·16, the highest rate recorded within recent years. While the decennial admission-rate was 67 with a death-ratio of 3·16, the admission-rate of the year was 37 with a death-ratio of 3·16, which indicates the severity of the cases treated during the past year. The number of casualties in the Madras Army increased the average ratio for the whole Army of India to the extent of giving a higher ratio of mortality from hepatitis (1·56) than has been recorded since 1880, with the exception of 1881, the ratio of which year included the casualties occurring among troops on active service and on the march. The high death-rate from hepatitis in the Madras Presidency was exceeded in Bengal proper, and in the Hill stations and Hill convalescent depôts of the Madras and Bombay Presidencies. There were 9 deaths with a death-rate of 4·55 in Lower Bengal, and 8 deaths with a ratio of mortality of 8·34 in the Hill stations of Madras and Bombay.

Respiratory diseases.

The admission-ratefor respiratory diseases (60 per 1,000) remained unchanged, and the death-rate (0·68 against 0·62 per 1,000 in 1886) shows only a very slight increase during the year. There have been no deaths from minor throat affections for the past three years. The general ratio of mortality from respiratory diseases proper was exceeded in the Bengal Presidency, and in Bombay the ratio fell to the low average of ·36. There was no death from this cause in the stations of Bengal proper, and only 1 in the Gangetic Provinces group. The Meerut and Rohilkund and Punjab groups had each a death-rate above the general average. In the Quetta district the ratio of mortality from respiratory diseases, chiefly pneumonia, was 2·59, and in the stations of Southern India the death-rate was ·93. The death-rate in the Hill stations of the Bombay and Madras Presidencies was 1·04, while in the Hill convalescent depôts of Bengal it reached 1·40.

Venereal disease.

There was a satisfactory decrease in the admission-rate for venereal disease in the European Army of India. As compared with 1886, the ratio of admissions fell from 389 to 361, and the progressive increase which marked the ratios of former years thus received a decided check in the Bengal and Bombay Presidencies. In Madras, however, there was a slight increase to the extent of 6 per 1,000. The decrease in the general admission-rate in 1887 is all the more important as there had previously been a steady and progressive increase in sickness from such cause in all three

presidencies year by year, and in 1886 all the ratios were higher than they had ever been, and nearly double in each instance the decennial averages of 1870–79 :—

Admissions from Venereal Diseases in the three Presidencies.

Presidency.	Admissions per Mille.									
	1860–69.	1870–79.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Bengal - -	265	209	276*	276*	271	281	291	363	394	356
Madras - - -	†	198	275	258	288	289	307	350	394	400
Bombay - -	†	191	269	261*	224	218	292	272	370	337
India - -	†	203	250	260	265	270	294	343	389	361

* Excluding troops in Afghanistan.
† The statistics of Madras and Bombay, and for the whole of India for these years are not available.

In 1887, 1,443 men were invalided, or 22·57 per 1,000 of average strength, against 1,303 men, or 21·10 per 1,000 of average strength in the previous year. There was an increase in the ratio in all three presidencies, and this increase was most marked in Madras (from 23·86 to 30·79 per 1,000). The proportion of invalids to strength was least, as usual, in Bengal, and greatest in Madras, the ratio in Bombay remaining nearly the same as in 1886. Invaliding.

The proportion of invalids recommended for discharge from the service was 37 in the Army generally against 41 in 1886. The percentage of those invalided as unfit for further service is shown in the following table :—

Percentage of those invalided for discharge to total number invalided.

—	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Army of India -	35	37	39	41	40	41	37
„ Bengal -	43	40	45	45	43	46	41
„ Madras -	32	38	40	36	47	42	43
„ Bombay -	17	26	21	33	29	28	22

The numbers invalided for discharge were fewer than in 1885 and in 1886. In Madras, however, corresponding with the greater number invalided, and the rise in the invaliding ratio, there was an increase of one in the percentage of those invalided as incapable of further service.

The chief causes of invaliding remained the same in the Bengal Presidency. The increase in the invaliding ratio in Madras was due to venereal disease, injuries, dysentery, rheumatism, and fevers. Eye affections and mental diseases show a ratio over 1 per 1,000 in Bombay, and accordingly have been added as principal causes of invaliding during the current year, while fevers may be excluded from the list of chief causes, as the ratio was only ·62 as compared with 1·18 in 1886. There was an increase in the number of invalids from mental diseases both in Bengal and Bombay, while in Madras there was a decrease. All the invalids in Madras and Bombay were entered for discharge, except 1 in Bombay, while 8 of the total 37 in Bengal were recommended "for change of air and climate" only. Bombay and Madras show higher ratios of invaliding from such causes than Bengal. Dementia and melancholia are the chief phases of mental disease in all three presidencies.

The invaliding of the year was not exceptional. The percentage of men under 25 years of age invalided was 49·41 against 43·92 in 1886. At all other ages, the percentage of invaliding was less. The slight increase in the general ratio of invaliding was, therefore, due to an increase in the number of invalids under 25 years of age.

The following tables show the influence of length of service and of residence in India on invaliding :- 52·88 per cent. of the total number invalided were under 5 years' service. Under a system of short service the percentage noted is what might be expected.

Number of men under 2 years', and between 2 and 5 years', service Invalided per cent. of total number Invalided.

Service.	1887.	1886.	1885.	1884.	1883.	1882.
Under 2 years -	25·02	24·31	22·56	24·19	18·94	17·35
2 to 5 years - - -	52·88	49·85	54·64	49·97	57·81	57·30

Again, 73 per cent. of the men composing the Army of India had not more than 5 years' Indian service, and 77·90 per cent. of the total invalided had been less than 5 years in India.

Table showing percentages of men up to 5 years' residence in the Army of India and percentages of these men invalided to total invalided.

Residence.	1887.	1886.	1885.	1884.	1883.	1882.	1881.	1880.
0 to 5 years' residence -	73	75	73	75	75	72	70	65
Invalided - - -	77·90	74·46	77·20	74·16	76·75	74·65	71·75	67·66

Vital statistics of newly-arrived regiments.

The comparison of the vital statistics of newly-arrived regiments with those of the army generally cannot be drawn with the accuracy of former times. The system of short service, entailing constant reliefs, and the interchange of young soldiers in different corps, vitiate to a great extent any attempt at such a comparison. The relative experience of newly-arrived corps in 1887 for the first year of their residence in India is shown as follows:—

Experience of newly-arrived Regiments in 1887 *(during their first year of Indian residence).*

—	Strength.	Ratio per 1,000 of Strength.							
		Admission-rate.	Daily Sick-rate.	Death-rate.	Deaths from				
					Enteric Fever.	Other Fevers.	Apoplexy and Heat-stroke.	Dysentery and Diarrhœa.	Hepatitis.
Army generally -	63,515	1369·7	70·3	14·20	3·76	0·74	0·85	0·71	1·56
New regiments -	3,279	1394·3	68·1	12·50	4·88	0·30	0·91	0·91	1·52

The greater mortality from enteric fever in regiments new to India, compared with the mortality from the same cause in the army generally, is, as usual, the marked feature in such a comparison.

Statistics of women and children.

The average number of women (3,242) was lower and, with the exception of 1883, when the average number stood at 6,015, there were fewer children (6,333) on the rolls of the European army of India than at any former period. The mortality amongst women was greater than in the previous year (18·20 against 15·92 per 1,000). There were in all 59 deaths in the three presidencies: 7 resulting from the accidents and diseases of child-birth, 6 from cholera, 6 from phthisis, 6 from dysentery and diarrhœa, 5 from anæmia and debility, 4 from enteric fever, 4 from heat-stroke, and 21 from all other causes. Anæmia and debility, fevers, respiratory diseases, diarrhœa, rheumatism and neuralgia, and eye diseases were the chief causes of sickness. There were 18 admissions from enteric fever with 4 deaths, against 19 admission with 8 deaths in 1886. The death-rate was lowest in the Bombay Presidency, in which there were 9 deaths—2 from the accidents of child-birth, 2 from cholera, 2 from phthisis, and 3 from other causes. In the Madras Presidency, 2 deaths were recorded

from enteric fever, 2 from phthisis, and the other deaths were due to general causes. Sickness was proportionately greater in the Madras than in the other presidencies, and least in Bombay. In all three presidencies the principal causes of admission were anæmia and debility, to which more than one-third of the total number of admissions was due. The increase in the death-rate of the year was due to cholera and general causes. There was a lessened death-rate from enteric fever, phthisis, and the diseases of childbirth.

The sickness and mortality among children were greater than in 1886. The admission-rate was 649·5 against 598·0, and the death-rate 51·79 against 45·48. Convulsions and teething, diarrhœa, anæmia and debility, respiratory diseases and fevers, were the chief causes of mortality. There were 7 deaths from croup and diphtheria against 11 in the in the previous year. Measles was more prevalent, and whooping-cough and small-pox less so. Cholera gave 8 admissions, with 7 deaths. The increase in the death-rate was due to measles, cholera, diarrhœa, anæmia and debility, and respiratory diseases. The highest rate of mortality was among children of the Bombay, and the lowest among the children of the Bengal Presidency. The sick-rate was highest in the Madras, and lowest in the Bengal Presidency. There were 93 deaths in the Madras Presidency, and the chief causes of mortality were diarrhœa, convulsions and teething, anæmia and debility, and fevers. Of the 58 deaths in the Bombay Presidency, 17 were due to convulsions and teething, 11 to diarrhœa, and 5 each to measles, anæmia and debility, and respiratory diseases The chief causes of mortality in Bengal were convulsions and teething, diarrhœa, respiratory diseases, anæmia and debility, cholera and measles. Whooping-cough was present in Bengal in April only, in Madras for nine months of the year, and in Bombay for four months. The distribution of mortality in the three presidencies was as follows:—Bengal 50·37 against 44·46 in 1886; Madras 53·54 against 45·35; and Bombay 53·60 against 48·74. Cholera was absent in the Madras and Bombay Presidencies, and there were in all 7 deaths from the disease among the children in Bengal. There were 4 deaths from enteric, and 20 from remittent and continued fevers. Small-pox was less prevalent in Bengal than in 1886. Measles and whooping-cough were common in the Bombay Presidency. Whooping-cough prevailed in the Madras Presidency, as in the previous year, but was rare in Bengal. Measles prevailed to a considerable extent in all three presidencies. Twenty-five per cent. of the total mortality was due to convulsions and teething, 18 per cent. to diarrhœa, 11 per cent. to anæmia and debility, and 10 per cent. to respiratory diseases.

Native Troops.

Sickness and mortality in 1887.

The general health of the Native Army of India was more satisfactory than in 1886. The death-rate was only 11·68 against 13·27 in 1886, and 13·67 in 1885. The total mortality was less, as usual, than among European troops, and was only one-third of that of the prison population.

Sickness and Mortality during the years 1877 *to* 1887.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81 -	118,669	1,422	48	1·94	24·90	27·40
1877 - -	113,966	1,030	32	1·53	10·90	13·38
1878 - -	117,273	1,460	43	2·06	18·04	21·02
1879 - -	121,107	1,735	58	4·61	35·15	37·79
1880 - -	126,385	1,545	56	0·53	39·22	41·12
1881 - -	114,612	1,305	46	0·97	19·24	22·62
1882 - -	114,894	1,129	37	1·02	12·24	14·76
1883 - -	114,830	923	31	1·15	11·76	14·31
1884 - -	114,827	1,042	33	0·71	10·50	12·22
1885* - -	115,486	978	32	1·61	13·67	16·09
1886* - -	106,010	973	31	1·27	13·27	19·46
1887* - -	105,254	1,045	33	1·31	11·68	18·17

* Excluding men on active service in Burma.

Intermittent fever, abscess, wounds resulting from accident, dysentery, respiratory diseases, rheumatism, and diarrhœa were the chief causes of sickness; while respiratory diseases, fevers, cholera, phthisis, dysentery, diarrhœa, and debility were the principal causes of mortality. There was a considerable increase in the admission-rate for fevers, and a slight rise in the same rate for dysentery and diarrhœa; and a decline in the number of cases of respiratory diseases, rheumatism, and neuralgia. Although the death-rate declined generally, there was a slight increase in the ratio of mortality from cholera, small-pox, and enteric fever. There were 15 deaths from enteric fever against 5 in 1886. The deaths from small-pox were double those of the previous year. The mortality from dysentery and diarrhœa was less. Scurvy was not more prevalent, but the death-rate was higher, and 12 deaths were reported against 9 in 1886. Respiratory diseases were, as usual, the chief cause of mortality (3·08) per 1,000. The excessive mortality from respiratory diseases, and the low mortality from enteric fever (0·14), in the Native Army, are in marked contrast with the low death-rate from respiratory diseases (0·68), and the high death-rate from enteric fever (3·76) in the European Army.

Bengal Native Army.

Both the admission and death ratios of the Native Army of Bengal were less than in 1886. With the exception of 1883, there was actually less sickness than in any year since 1877. There were fewer admissions for respiratory diseases, dysentery, rheumatism, and injuries, but an increase in the admission-rate for fevers. The death-rate was 12·63 against 14·45 in 1886, and the health of the Native Army of Bengal, as a whole, was very satisfactory.

Sickness and Mortality during the ten-year period, 1867 *to* 1876, *and of the years* 1877 *to* 1887 *compared.*

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1867–76	39,508	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	36,896	1,495	51	0·92	19·76	27·73†
1882	40,256	1,250	41	0·72	13·34	16·49
1883	40,932	985	32	0·56	10·55	13·98
1884	40,850	1,193	35	0·71	10·97	12·56
1885‡	40,753	1,076	34	0·29	10·11	14·18
1886§	40,547	1,065	34	1·87	14·45	22·29
1887§	42,586	1,057	35	1·50	12·63	19.95

* Excluding troops in Afghanistan.

† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

‡ Excluding men on active service in Burma and Egypt.

§ Excluding men on active service in Burma.

The chief causes of sickness were the same as for the Army of India generally, although in Bengal, in 1887, diarrhœa shows a higher admission-rate than rheumatism and neuralgia. The admission-rate for intermittent fever was 488·6 against 456·2 in 1886, and this records the only important increase in sickness from individual causes. The admission-rates for respiratory diseases and dysentery were 49·5 and 54·3 against 54·6 and 58·4 in the previous year. The highest ratios of mortality were from respiratory diseases 3·19, from remittent and intermittent fever 2·18, from cholera 1·50, from phthisis 1·15, and from dysentery ·85. There was an increase in the death-rate from enteric fever, and there were 5 deaths from this cause against 1 in 1886. Dysentery and diarrhœa were less fatal than usual. There was only 1 death from small-pox against 2, 64 from cholera against 76, and 6 from scurvy against 3, in the previous year.

The sickness and mortality among Native Troops, in the stations comprised in the different geographical groups, are conveniently tabulated thus—

Year.	Ratio per 1,000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76 -	1,523	19·13	1,062	8·38	987	11·19	1,588	9·61	1,459	14·24
1877 -	1,492	19·64	768	5·19	642	9·52	906	7·41	1,243	8·85
1878 -	1,527	22·13	1,036	7·88	1,008	9·83	1,581	12·96	1,896	18·33
1879 -	1,816	25·57	1,658	11·05	2,038	36·17	2,303	16·07	2,173	47·64
1880 -	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881 -	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	22·86
1882 -	1,569	18·22	1,081	10·01	1,083	9·98	1,248	7·18	1,268	13·30
1883 -	1,408	16·23	970	8·17	978	11·53	906	5·77	830	10·80
1884 -	1,367	14·61	929	6·00	1,188	10·62	1,312	7·84	1,083	8·49
1885 -	1,278	9·96	990	6·42	1,179	10·04	1,333	8·28	902	9·92
1886 -	1,692	38·45	896	5·35	1,349	13·64	1,386	6·90	779	8·61
1887 -	1,462	14·32	906	7·54	1,258	21·39	1,220	8·36	894	10·33

Bengal Proper and Assam show the highest admission-rate, and Rohilkund and Meerut, and Agra and Central India follow each other closely with admission-rates of 1,258 and 1,220 respectively, although some of these groups were more healthy than in 1886. There was a slight increase in sickness in the stations of the Gangetic Provinces and the Punjab. Mortality was higher in the Rohilkund and Meerut group than elsewhere. And the death-rate in this group rose to 21·39 per 1,000 of average strength, the highest ratio in those stations since 1880. This increase of mortality in the Rohilkund and Meerut stations was due to cholera, remittent fever, and dysentery, and there were 33 deaths from cholera against 3, and 18 deaths from remittent fever against 5 in 1886. The decline in the death-rate in Lower Bengal and Assam from 38·45 in 1886 to 14·32 in 1887 is accounted for by the lessened mortality from cholera, fevers, dysentery, and diarrhœa, and the diminution in sickness generally. The rise in the ratio of mortality in the Gangetic Provinces was due to cholera, and in the stations of the Punjab to the increased death-rate from dysentery, diarrhœa, and phthisis, from which there were 21 deaths against 10 in the previous year.

The chief causes of sickness in the different geographical groups of stations, during 1886 and 1887, are shown in the table which follows. Lower Bengal and Assam stations, it will be observed, returned during both years the highest ratio of admissions from fevers, bowel diseases, and splenic complaints, and this is in accordance with the general belief that such diseases are more common in Lower Bengal than elsewhere. The Rohilkund and Meerut stations follow next with the highest average ratio of admissions from such causes; but the great difference in the admission-rate for bowel complaints, as compared with the same rate as given for the stations of Lower Bengal, is a marked feature of the statistics as tabulated—

Groups.	Ratio of Admission per 1,000 of Strength.											
	Fevers.*		Bowel Complaints.		Spleen. Diseases.		Respiratory Diseases.		Rheumatism and Neuralgia.		Abscess and Ulcer.	
	1887.	1886.	1887.	1886.	1887.	1886.	1887.	1886.	1887.	1886.	1887.	1886.
Lower Bengal and Assam - -	712	779	168	291	12	10	81	82	30	40	108	89
Gangetic Provinces - - -	362	371	64	60	6	6	29	29	26	36	130	110
Rohilkund and Meerut - -	628	742	85	61	7	7	68	66	26	38	100	107
Agra and Central India - - -	647	677	76	55	5	4	38	51	38	49	151	154
Punjab - - - -	447	312	57	38	4	5	35	41	20	30	93	92

* Intermittent, remittent, simple continued, and enteric fevers

The high admission-rate for respiratory diseases in Lower Bengal and Assam, followed closely by the Rohilkund and Meerut stations, would seem to indicate that the minor and less fatal forms of respiratory disease are of more frequent occurrence

in damp and moist climates, where fevers and splenic complaints are most rife. In fact, the less fatal types of respiratory disease are much more common in Lower Bengal than in the colder, and much more variable, climate of the Punjab.

The varying incidence and mortality from cholera in different years are well illustrated in the following table, which also indicates the diverse ratios of mortality year by year from the same cause in the different groups of stations:—

Chief causes of Mortality in the several Groups of Stations of the Bengal Presidency during 1886 *and* 1887.

Groups.	Ratio of Death per 1,000 of Strength									
	Cholera.		Fevers.*		Bowel Complaints.		Respiratory Diseases.		Total, all Causes.	
	1887.	1886.	1887.	1886.	1887.	1886.	1887.	1886.	1887.	1886.
Lower Bengal and Assam	1·77	10·52	2·47	5·36	3·71	13·39	2·12	1·34	14·32	38·45
Gangetic Provinces	2·01	·50	1·18	·13	·50	1·01	·83	·66	7·54	5·35
Rohilkund and Meerut	6·25	·57	4·36	2·27	1·89	·76	3·97	3·98	21·39	13·64
Agra and Central India	1·57	·—	·78	1·14	·52	·58	1·83	1·72	8·39	6·90
Punjab	·15	·05	2·30	2·00	1·12	·22	3·18	3·14	10·33	8·61

*Intermittent, remittent, simple continued, and enteric fevers.

The highest ratios of mortality, corresponding with the highest ratios of sickness from fevers and bowel complaints, are recorded in Lower Bengal and the Rohilkund-Meerut group of stations, in which the death-rate from fevers was in excess of those of Bengal in 1887. The fall in the death-rate from bowel complaints corresponding with a fall in the death-rate from cholera in Lower Bengal was very marked, and the ratio of mortality from this cause was only 3·71, as compared with 13·39 in 1886. The rise, on the other hand, in the death-rate from this cause in the Rohilkund and Meerut group corresponds with a great increase in the cholera ratio of the year. The analogy does not, however, hold, for with a diminished death-ratio from bowel complaints in the Gangetic provinces, there was a considerable rise in the ratio of mortality from cholera. The greatest fatality from respiratory diseases was in the stations of the Rohilkund and Meerut group, and the death-rate from this cause was 3·97, as compared with 3·18 in the Punjab. As in 1886, so in 1887 the highest death-rate from such causes was in the former stations, and not in those of the colder region of the Punjab.

The sickness and mortality at Tummoo and outposts were greatly under that recorded in 1886. The admission-rate from all causes was 3,203·5 against 5,286·7 per 1,000 of average strength, and the death-rate only 24·81 against 328·67 (for eleven months only) in the previous year. There was a total of 10 deaths only, of which 8 were from cholera, and 2 from remittent fever. The stations of Alipore, Silchar and outposts, Shillong and outposts, Sutna, Delhi, Ludhiana, Kohat, Edwardesabad, Dera Ismail Khan, and Quetta, all recorded an admission-rate of over 1,500 per 1,000 of average strength. Delhi, Kohat, and Edwardesabad each had an admission-rate of over 2,000, the excess in the admission-rate being due to the proportionately large number of admissions from intermittent fever. The small station of Sutna, with an average strength of 50 only, had an admission-rate of 2420·0, of which 1040·0 were due to intermittent and remittent fevers.

The following stations and outposts recorded a ratio of mortality exceeding 20 per 1,000 of average strength:—Quetta district, 68·54; Phillour, 37·50; Dehra Dun, 35·20; Moradabad, 28·37; Tummoo and outposts, 24·81; Delhi, 23·33; Shillong and outposts, 23·00; Ludhiana, 20·83. There was a total of 44 deaths in the Quetta district, of which 20 were from pneumonia, 5 from scurvy, 4 from anæmia, and 3 each from dysentery and remittent fever. The death-rate, though still excessive, showed a great decrease on that of 1886, when it stood at 109·87 per 1,000 of average strength. The small garrison of Phillour, with an average strength of 80, recorded 3 deaths, 2 from remittent fever, and 1 from pleurisy; Moradabad, with an average strength of 141, returned 4 deaths, 1 from cholera, 2 from dysentery, and 1 from heart-disease; and Ludhiana, with an average strength of 48 only, returned 1 death from remittent fever. Dehra Dun, with an average strength of 1,449, returned 51 deaths, of which

28 were due to cholera, 8 to phthisis, and 4 to remittent fever; and the excessive death-rate of the year at that station was for the most part due to a virulent outbreak of cholera in the month of August. The mortality at Delhi was due to respiratory diseases and remittent fever, 8 of the 15 deaths being due to the former and 5 to the latter cause, and there was 1 death from dysentery and 1 from accidental gun-shot. Of the 17 deaths at Shillong and outposts, 5 were due to pneumonia, 5 to intermittent and remittent fevers, 2 to spleen diseases, 2 to dysentery, and 1 to diarrhœa.

Three regiments of Bengal Infantry serving on the Eastern Frontier, six regiments serving in Rohilkund, one regiment serving in the Agra district, four regiments serving in the Punjab, and one regiment serving in the Quetta district, and ten regiments serving in Upper Burma, recorded a ratio of mortality of over 20 per 1,000 of average strength. The highest average mortality, in any one regiment, was 114·94 per 1,000 of average strength in the 5th Bengal Infantry, on duty in Upper Burma. The highest death-rate among troops on the Eastern Frontier was 36·70 in the 6th Native Infantry head-quarters at Shillong; among troops in Rohilkund 40·46 in the 26th Native Infantry at Meerut; among troops in the Agra district 23·31 in the 28th Bengal Infantry at Agra; among troops in the Punjab 107·56 in the 14th Bengal Cavalry on the march from Quetta and at Sialkot; and among troops in the Quetta district 29·51 in the 3rd Bengal Cavalry at Loralai. The principal causes of death in Upper Burma were bowel complaints, fever, injuries, and debility; in Rohilkund, cholera, fevers, pneumonia, phthisis, and bowel complaints; in the Agra district, fevers, cholera, phthisis, and pneumonia; in the Punjab, pneumonia, fevers, bowel complaints, and phthisis; and in the Quetta district, pneumonia and scurvy. The 5th Bengal Infantry in Upper Burma lost 100 men of a total strength of 870, 36 from dysentery and diarrhœa, 17 from anæmia and debility, 15 from fevers, 11 from all other causes, and 21 died while on leave. The 14th Bengal Cavalry, on relief from Quetta to Sailkot, lost 64 men of a total strength of 595, 22 from pneumonia, 6 from anæmia and debility, 4 each from bronchitis and fevers, 3 from scurvy, and 7 from all other causes, and 18 on leave. The severe nature of, and the fatality resulting from, service in Upper Burma, and at the outposts of the Quetta district, are indicated by the experience of the regiments noted.

There was a general increase in sickness and mortality among the troops comprising the Punjab Frontier Force in 1887. The admission-rate rose from 979 to 1,687, and the death-rate from 9·83 to 11·87. Intermittent fevers were the chief cause of sickness, and the admission-rate from this cause was 1,087·8 against 464·8 in 1886. Dysentery, diarrhœa, and cholera added to the sickness of the year. The increase in mortality was due to cholera, small-pox, fevers, respiratory diseases, dysentery, and diarrhœa. Cholera, from which there was a total immunity during the previous six years, appeared in an epidemic form in August and September, and there was a total of 34 cases from April to August, with 19 deaths. Small-pox was likewise prevalent, and there were 25 admissions with 5 deaths against 4 admissions and 1 death in 1886. Remittent fever was also more fatal, and 2 deaths occurred from enteric fever. The following regiments of the Punjab Frontier Force recorded a death-rate of over 20 per 1,000 of average strength:—

No. 4 Mountain Battery, on relief from Burma to Kohat	24·15
3rd Punjab Cavalry, at Dera Ismail Khan	24·12
No. 2 Mountain Battery, Quetta district	22·94
4th Sikh Infantry, at Kohat	21·79
1–5th Goorkhas, at Abbottabad	21·25
1st Mountain Battery, at Edwardesabad	21·10
2–5th Goorkhas, at Abbottabad	20·70

Of the total 5 deaths in No. 4 Mountain Battery at Kohat, 4 occurred among men on leave, and 1 from fever at Kohat. In the 3rd Punjab Cavalry 15 deaths were recorded, 6 from pneumonia, 2 from debility, 3 from all other causes, and 4 while on leave. Five deaths were recorded in No. 2 Mountain Battery, 2 from pneumonia, 1 from other causes, and 2 while on leave. Of the 19 deaths in the 4th Sikh Infantry, 6 were from fevers, 4 each from cholera and pneumonia, 3 from other causes, and 2 while on leave. Eighteen deaths occurred in 1–15th Goorkhas, 4 from pneumonia, 3 each from cholera and fevers, 4 from other causes, and 4 while on leave. Of 5 deaths in the 1st Mountain Battery, 2 were from injuries, and 1 each from pneumonia, bronchitis, and cholera. There were 10 deaths in the 2–5th Goorkhas, 5 from pneumonia, 2 from fevers, and 3 from all other causes.

The health of the Central India Irregular Force compares favourably with that of the Punjab Frontier Force, and sickness and mortality are usually much less. The ratios of admission and mortality were 755 and 7·16 per 1,000, respectively, against 719 and 6·67 in 1886.

At Ajmere and outposts no deaths were recorded, and the admission-rate was only 277·5 per 1,000 of average strength. Sickness was greatest at Erinpura and outposts, and the chief causes of admission were intermittent fever, wounds resulting from accident, eye affections, abscess and ulcer, and diarrhœa. There were 12 admissions from guinea-worm at that station. Erinpura also shows the highest death-rate, namely, 13·21 per 1,000 of average strength. There were 10 deaths: 4 from fevers, 2 from hemiplegia, 2 from heart-disease, 1 from pneumonia, and 1 from alcoholism,—an unusual cause among native troops. One death from snake-bite was recorded at Agar, and 1 from hydrophobia at Deolí. The Erinpura Battalion was, as usual, one of the sickliest of the regiments comprising the Central India Irregular Force, and the admission and death rates were 985·7 and 13·87 respectively, as compared with 275·8, and nil in the Mhairwara Battalion. The Bhopal Battalion had an admission-rate of 1,055·1, and a death-rate of 9·59, and the Malwa-Bheel Corps returned an admission and a death-rate of 760·9 and 9·85 respectively. The chief causes of deaths in these corps were fevers, pneumonia, cholera and general causes.

The general health of the troops comprising the Hyderabad Contingent was not so satisfactory as usual, the admission-rate having risen from 483 per 1,000 in 1886, to 614 in 1887, and the death-rate from 5·34 to 9·6. While the health of the Central India Irregular Force compares favourably with that of the Punjab Frontier Force, the health of the troops of the Hyderabad Contingent compares favourably with that of the Central India Irregular Force. The death-rate, however, in the Hyderabad Contingent was greatly in excess in 1887, and exceeded the ratio of mortality in the Central India Irregular Force. This exceptional rise in the death-rate, among the troops forming the Hyderabad Contingent, was due to the indirect influence of service in Upper Burma. Of the four cavalry regiments, one was on field service and of the six infantry regiments, two were also on field service in Upper Burma. The 3rd Cavalry on field service lost 10 men from all causes, and the 3rd Infantry 14, and the 2nd Infantry 12 men—all in Upper Burma (except 3 men of the 2nd Infantry, who died at Hingoli). The death-rate of the year was also increased by the occurrence of cholera at Akola, where three deaths were recorded from this cause; at Hingoli, where two deaths occurred; and at Aurangabad and Bolarum, each of which returned one death. There were three deaths from scurvy,—one at Ellichpur, one at Amroati, and one at Bolarum.

Madras Native Army.

The indirect influence of active service in Upper Burma still affected the death-rates among the troops composing the Madras Army. The mortality from all causes was, however, considerably less than in 1886; but, including the deaths of men absent from their regiments, on sick leave and for other reasons, the general ratio of mortality was slightly in excess of that of 1886, as shown in the following table:—

Sickness and Mortality during the last Eleven Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	28,304	861	28	2·79	11·89	14·36
1878	28,728	841	29	2·23	12·25	15·49
1879	27,314	1,269	43	3·19	18·89	21·23
1880	28,710	1,399	54	0·10	15·57	19·54
1881	28,533	997	41	1·37	12·02	16·75
1882	27,654	879	30	2·46	12·01	14·99
1883	27,703	737	27	2·92	10·76	12·51
1884	28,050	836	31	1·46	10·02	11·82
1885*	27,043	675	25	1·29	9·69	13·96
1886†	22,070	756	30	2·5	14·05	21·25
1887†	20,031	772	32	1·49	11·53	22·22

* Excluding men on active service in Burma and Egypt.

† Excluding men on active service in Burma.

The mortality among troops actually present was less than in 1886. There were fewer deaths from cholera, respiratory disease and debility. Although there were 26 admissions from small-pox, there was no death from the disease. The relative mortality from intermittent fever (1·40) is very high, as compared with the mortality from this cause among European troops (0·12). The low ratio of mortality from enteric fever (0·10) is in great contrast with the relatively high death-rate (2·98) from this cause among the European troops located in the Madras Presidency.

Secunderabad is the only one of the large stations in the Madras Presidency, which is reputedly unhealthy, and is characterised year by year by its exceptional sick and death-rates. The admission-rate at Secunderabad was 1083·7, and the death-rate 14·45, which, however, includes a ratio of mortality from cholera alone of 4·93. Bangalore, with its large garrison of 2,703 average strength, returned an admission-rate of only 583·8, and a death-rate of 12·21. The garrison of Madras, with an average strength of 1,276, recorded an admission-rate of 839·3 and a death-rate of 9·40. Of all the stations of Madras, none shows a ratio of mortality of over 20 or an admission-ratio of over 1,300, and there were no deaths in the stations of Jubbulpore, Sambalpur, Cuttack, Samulcotta, and Saint Thomas' Mount.

Of the Burma stations included in the Madras Presidency, the greatest mortality occurred at Toungoo, where the ratio of mortality was 27·46. There were 12 deaths in a garrison of 437 average strength: 7 of the deaths were from intermittent fever, 2 from debility, 1 each from dysentery, diarrhœa, and pneumonia. Twenty-three deaths occurred in the garrison of Rangoon with an average strength of 948, and fevers, dysentery, and diarrhœa were the chief causes of mortality. There were three deaths from beri-beri, and 1 from spinal meningitis, and the death-rate from all causes at Rangoon was 24·26. In none of the garrisons of Lower Burma did the admission-rate exceed 1070·5, recorded at Moulmein, which returned a death-rate of 10·08 or a total of 4 deaths: 2 from fevers, 1 from diarrhœa, and 1 from beri-beri. The garrison of the Andamans and Nicobars, with an average strength of 415, recorded the high admission-rate of 2231·3, which is greatly in excess of the admission-rate of any other garrison occupied by Madras Troops. Of this admission-ratio 1780·7 was noted under the heads of intermittent, remittent and simple continued fevers. The death-ratio was 14·46, and the total deaths 6, including 3 from fevers, 1 each from dysentery, diarrhœa, and abscess of the liver.

The 23rd Madras Infantry at Sitabaldi, recently arrived from Upper Burma, recorded a death-rate of 46·90 per 1,000. There were 25 deaths in this corps: 4 from debility, 3 each from fevers, dysentery and diarrhœa, 5 from all other cases, and 10 while absent from the regiment. The 14th Madras Infantry in Upper Burma had a death-rate of 111·25 per 1,000, and 87 deaths were recorded: 22 from dysentery and diarrhœa, 20 from fevers, 13 from debility, 4 from injuries, 9 from all other causes, and 19 while absent on leave. Again, the 26th Madras Infantry at Toungoo returned a death-rate of 53·71. There were 42 deaths in this corps: 9 from fevers, 6 from debility, 2 from dysentery and diarrhœa, and 2 from all other causes, and 23 while absent on leave. Ten other regiments of the Madras Infantry recorded ratios of mortality varying from 49·31 to 25·52 per 1,000.

The exceptional mortality in the regiments of the Madras Infantry resulted for the most part from the exposure, and the incidents of active service, in Upper Burma. The mortality from all causes, including the deaths of men absent from their corps, was the highest since, and including 1877, and this high ratio of mortality generally was in excess of that of the Bengal Army.

As an exception to the high rate of mortality of regiments on service in Upper Burma, it may be noted that the 1st Madras Cavalry returned a death-rate of only 15·70 from all causes, including deaths of men absent from their corps, and this rate compares favourably with the same rate of every other regiment of the Madras and Bombay Armies on active service in Burma.

Bombay Native Army.

There was a marked improvement in the health of the Bombay Army, and the admission, daily sick, and death rates were all lower than in 1886. The death-rate, as shown in the table which follows, was only 11·50 as compared with 15·98; or if the deaths of men absent from their corps be included, the ratio was only 15·45 against 20·80 in the previous year:—

Sickness and Mortality during the last Eleven Years.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	23,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·36	15·12	17 95
1879	22,854	1,663	51	3·11	20·22	21·90
1880*	15,328	1,283	45	—	10·44	56·53‡
1881*	18,349	1,166	41	1·85	14·01	25·93‡
1882†	23,772	1,067	36	0·46	12·16	13·41
1883	23,576	994	35	0·47	12·81	14·96
1884	23,373	1,153	38	0·39	12·96	14·35
1885§	22,701	1,243	43	5·42	24·84	26·01
1886§	21,089	1,231	37	0·14	15·98	20·89
1887§	23,353	1,092	34	0·69	11·50	15·45

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.
§ Excluding men on active service in Burma and Egypt.

There was less sickness and fewer deaths from fevers, respiratory disease, and dysentery. Cholera was slightly more prevalent, and there were 14 deaths against 3, and 1 death from small-pox against none in 1886. Scurvy was the cause of 3 deaths; and, although sickness from this cause was less, the mortality was greater.

Quetta and the Quetta district, were the most unhealthy of all the other stations and districts in which Bombay troops were located. The admission-rate of the Quetta district was 1976·9, and the death-rate 27·03. The chief causes of sickness in the Quetta district were fevers, respiratory disease, dysentery and diarrhœa; and of mortality, respiratory disease and remittent fever. Kirkee shows a high sick-rate, chiefly from fevers, venereal and respiratory diseases; but the low death-rate of 5·24. Deesa had an admission-rate of only 840·6, but a death-rate of 15·94; and there were in all 18 deaths at this station, including 12 from pneumonia. There were no deaths at Thana or Ahmednagar, and only one at each of the stations of Malegaon and Sadra. The large garrison of Poona recorded an admission-rate of 740·6, and a death-rate of only 6·64. Aden, with an average strength of 1,015, recorded an admission-rate of 685·7 only, and a death-rate of 9·85; and of the 10 deaths, which occurred at that station, none was from epidemic disease.

Of the Bombay Army, the 10th Infantry at Loralai, Quetta District, recorded a mortality of 38·98. There was a total of 32 deaths; 10 from pneumonia and pleurisy, 6 from fevers, 5 from dysentery and diarrhœa, and 6 from all other causes, and 5 of men absent on leave. No. 2 Mountain Battery at Loralai and Poona, recorded a death-rate of 38·96; and 9 deaths were noted; 3 from pneumonia and pleurisy, 3 from all other causes, and 3 of men absent on leave. The 25th Bombay Infantry in Upper Burma returned a ratio of mortality of 37·08, and there were 31 deaths in this corps; 14 from fever, 3 from dysentery and diarrhœa, and 5 from all other causes, and 9 of men absent on leave. The 27th Bombay Infantry in Upper Burma also recorded the high death-rate of 27·47, and there were 25 deaths; 6 each from fevers, dysentery, and diarrhœa, 3 from bronchitis and asthma, 4 from injuries, and 6 from all other causes. The following other corps of the Bombay Army had death-rates of over 20 per 1,000 of average strength:—30th Bombay Infantry, at Quetta, 34·05; 6th Bombay Cavalry, at Quetta, 25·93; 19th Bombay Infantry, Quetta District, 22·87; 20th Bombay Infantry, at Deesa, 20·18. The 1st Bombay Cavalry, which was on service in Upper Burma throughout the year, recorded a death-rate of only 16·42, which compares favourably with the death-rate of the infantry regiments of the Madras and Bombay armies, also on active service in Burma.

The vital statistics of the troops, comprising the Native Army of India, are set forth in the following table; and the average strength of each section of the Native

Army is shown in connexion with the sickness and mortality from all causes in the army generally :—

Presidency.	Total Deaths per 1,000 including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army - -	19·95	42,586	1,057	35	1·50	12·63
Madras „ „ -	22·22	20,031	772	32	1·49	11·53
Bombay „ „ - -	15·45	20,353	1,092	34	·69	11·50
Central India Irregular Force -	8·40	5,305	755	20	·75	7·16
Punjab Frontier Force - -	14·88	11,961	1,687	38	1·59	11·87
Hyderabad Contingent - -	12·66	5,018	614	20	1·39	9·16
India - - -	18·17	105,254	1,045	33	1·31	11·68

The Central India Irregular Force and the Hyderabad Contingent, as usual, record the lowest admission, daily sick, and death rates. The Punjab Frontier Force returned the highest ratios of sickness, with an approximately high death-rate. Mortality from all causes was greatest in the Bengal Army; but, including the deaths of absentees, the Madras Army recorded the highest general death-rate. Cholera was more prevalent than in 1886, and each branch of the Native Army returned deaths from the disease, the highest ratio of mortality from this cause being 1·59 among the men of the Punjab Frontier Force.

Jails.

Sickness and mortality in 1887.

The temporary large decrease in the jail population of India owing to the release of many thousands during February 1887, on the occasion of the Jubilee of the Queen-Empress, vitiates to some extent the statistical data for the year. Although the average jail population as recorded was less, there were actually more prisoners convicted than in the previous year. While the average strength of the jails was less by 5,442, the sickness and mortality among the larger floating jail population were greater than in 1886. The admission, daily sick, and death rates were all higher than in the previous year. There was an increase in the mortality from cholera in the jails of Bengal; and in contrast with the complete immunity during 1886, the jails both of the Madras and Bombay Presidencies recorded deaths from the disease. The mortality from dysentery and diarrhœa was greater in the jails of the Bengal and Madras, and less in the jails of the Bombay Presidency. The rise in the death-rate generally is accounted for by the increased mortality from cholera, and by a slight increase in that from bowel complaints. It is satisfactory to note a decrease in the mortality from scurvy, anæmia, and debility. The increase in the death-rate of the jails of India as a whole was due to the rise in the mortality of the jails of the Madras and Bengal Presidencies; 12 per cent. of the total deaths were due to cholera, 34 per cent. to bowel diseases, 16 per cent. to respiratory diseases, 7 per cent. to fevers, and 7 to phthisis. There were only 4 deaths from small-pox throughout the prison population of all India, including Lower Burma.

Statement showing the Strength, Sickness, and Mortality among the Prisoners of India during the years 1872–76, 1877–81, *and* 1881 *to* 1887.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
1872–76 - -	99,758	1,016	?	2·86	13·48	36·24
1877–81 - -	112,670	1,189	45	4·48	24·97	63·01
1881 - - -	100,844	1,214	45	3·03	16·92	44·03
1882 - -	94,063	1,214	42	2·75	15·21	39·96
1883 - - -	88,174	996	36	2·28	10·64	31·37
1884 - -	85,496	1,025	37	1·43	9·73	29·11
1885 - -	82,650	1,014	36	3·44	11·18	33·54
1886 - - -	84,910	1,014	36	1·45	10·70	31·85
1887 - -	79,468	1,083	37	4·08	11·53	34·15

The proportion of prisoners to the general population of India was 4·1 per 10,000 as compared with 4·4 in 1886 and 4·2 in 1885; and the average number confined in each Presidency was less than in the previous year. The progressive annual decrease in strength which, with the exception of 1886, has been observed since 1877, is again apparent. The figures of 1887, however, are more or less fallacious for the purposes of comparison by reason of the exceptional jail delivery at the time of the Jubilee. The ratio of prisoners, per 10,000 of the free population in each of the three presidencies, is shown in the following table. There has been a satisfactory diminution in such ratios year by year in each presidency since 1881, the year of the last general census:—

Presidency.	Period.	General Population, according to Census of 1881.	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal	1872–76	147,215,384	68,328	4·6	39·39
	1881		63,478	4·3	44·42
	1882		59,489	4·0	42·56
	1883		54,982	3·7	34·28
	1884		51,877	3·5	32·71
	1885		49,404	3·4	38·40
	1886		50,028	3·4	32·32
	1887		47,306	3·2	36·36
Madras	1872–76	31,170,631	9,607	3·1	32·37
	1881		10,332	3·3	41·91
	1882		8,752	2·8	42·62
	1883		7,666	2·5	29·87
	1884		6,959	2·2	20·55
	1885		6,942	2·2	17·86
	1886		6,904	2·2	17·53
	1887		6,057	1·9	22·12
Bombay	1872–76	16,454,414	8,011	4·9	26·61
	1881		9,910	6·0	41·88
	1882		8,845	5·4	33·35
	1883		7,806	4·7	34·33
	1884		7,305	4·4	34·91
	1885		6,872	4·2	33·76
	1886		6,767	4·1	30·44
	1887		5,667	3·4	19·06

The sickness and mortality among prisoners in the Bengal Presidency were much greater than among the prisoners in the other presidencies. Prisoners confined in Bombay jails were exceptionally healthy, and the admission, daily sick, and death rates are the lowest on record. Even including the death-rate from cholera, the mortality in the jails of the Bombay Presidency did not exceed the average rate of a healthy free community. Madras showed an increased ratio of mortality, but the death-rate compares favourably with that of the Bengal Presidency.

Sickness and Mortality among Prisoners in the three Presidencies during 1887.

Presidency.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
Bengal	47,306	1,020	32	4·21	13·19	36·36
Madras	6,057	654	24	·16	5·95	22·12
Bombay	5,667	559	24	1·24	6·88	19·06

The general health of the prisoners in the Bengal Presidency was less satisfactory than in 1886. Cholera prevailed to some extent, and the death-rate from that cause alone rose from 1·78 to 4·21 per 1,000. Dysentery and diarrhœa were likewise more

fatal than in the previous year. The death-rate from all causes was 4·04 per 1,000 in excess of that of 1886.

The highest admission-rates were, as usual, for fevers, dysentery and diarrhœa, abscess and ulcer, and respiratory diseases. As compared with 1886, there was an increase in the admissions from fevers, respiratory diseases and cholera; and a decrease in the same rate for dysentery and diarrhœa and abscess and ulcer. The average ratio of admissions, while slightly above that of the previous year, was lower than that of 1885.

Statement showing the Chief Diseases which have caused Admissions into Hospital in the Jails of the Bengal Presidency from 1873 *to* 1887.

Number.	Diseases.	Decennial Average, 1873–82.	Admitted per 1,000 of Average Strength.														
			1887.	1886.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers	488	440	406	441	452	389	541	528	458	660	556	371	457	398	445	450
2	Abscess and ulcer	116	96	104	100	94	102	123	127	133	114	113	122	115	99	107	110
3	Dysentery	112	118	122	137	117	100	117	105	116	129	137	98	104	96	101	110
4	Diarrhœa	103	93	103	111	106	100	108	106	117	112	107	94	86	90	96	108
5	Respiratory diseases	44	49	44	40	36	39	45	48	48	21	45	43	41	37	45	44
6	Wounds and accidents	41	44	43	42	35	36	39	40	37	36	43	48	39	43	44	43
7	Anæmia and debility	23	34	36	34	28	27	28	28	28	29	28	24	19	16	15	19
8	Venereal diseases	17	18	19	17	18	18	21	20	20	18	18	15	12	23	16	12
9	Rheumatism	17	15	15	16	16	16	16	15	15	15	16	21	17	16	19	17
10	Eye diseases	13	13	15	17	14	13	13	15	13	14	11	13	12	11	12	13
	Total of the Ten	973	922	903	952	915	840	1,053	1,030	986	1,166	1,076	848	901	827	900	927
	Total from all Causes	1,091	1,020	1,003	1,060	1,028	949	1,178	1,151	1,108	1,285	1,182	967	1,017	943	1,028	1,043

Dysentery and diarrhœa combined gave the highest death-rate, and respiratory diseases, cholera, fevers, anæmia with debility and phthisis, follow in order of sequence. There was a slight decline in the mortality from phthisis and debility, but a rise in the death-rate from cholera, dysentery and diarrhœa and respiratory diseases. The death-rate from all causes was higher than in 1886, but lower than in 1885, and considerably under the average of the decennial period from 1873–82.

Statement showing the Diseases which have been the chief causes of Mortality among Prisoners of the Bengal Presidency from 1873–1887.

Number.	Diseases.	Decennial Average, 1873–82.	Died per 1,000 of Average Strength.														
			1887.	1886.	1885.	1884.	1883.	1882.	1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhœa	18·90	13·19	11·81	14·68	12·66	12·93	17·31	17·91	21·51	30·65	28·27	10·59	14·75	12·38	16·98	16·63
2	Respiratory diseases	7·18	6·87	5·85	5·83	6·03	6·00	7·26	7·62	9·38	9·53	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers	5·29	2·56	2·82	2·49	2·16	2·38	3·53	4·65	4·45	13·82	7·40	1·97	2·36	4·20	3·72	5·47
4	Cholera	3·46	4·21	1·78	4·07	1·52	2·35	3·11	3·10	1·00	6·38	5·34	3·07	4·24	2·35	2·48	2·97
5	Anæmia and debility	3·10	2·05	2·60	2·49	2·10	2·02	3·04	2·58	3·66	5·43	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis	2·50	1·86	2·24	2·41	2·12	2·31	1·98	2·24	2·53	3·00	2·76	2·36	3·24	1·86	2·51	2·38
7	Wounds and accidents	0·68	·78	0·54	0·69	0·46	0·44	0·62	0·55	0·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
8	Apoplexy	0·66	·55	0·52	0·63	0·52	0·60	0·39	0·58	0·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
9	Spleen diseases	0·35	·32	0·38	0·20	0·27	0·34	0·19	0·22	0·57	0·31	0·23	0·20	0·29	0·77	0·37	0·33
	Total of the Nine	42·12	32·39	28·54	33·49	27·84	29·37	37·34	39·45	44·61	70·54	59·80	27·84	33·63	29·36	34·85	38·21
	Total from all Causes	47·36	36·36	32·32	38·40	32·71	34·28	42·56	44·42	51·12	77·90	65·85	31·88	37·51	33·65	39·90	43·08

Four deaths from enteric fever, and 15 from cerebro-spinal fever were recorded. Dysentery and diarrhœa are invariably the chief causes of mortality in the jails of Bengal; and the death-rate for the past three years from bowel diseases is shown as follows:—

	Ratio per 1,000 of Average Strength.		
	1887.	1886.	1885.
Dysentery	8·64	7·61	10·16
Diarrhœa	4·55	4·20	4·52
	13·19	11·81	14·68

While the death-rate from diarrhœa remains more or less constant, that from dysentery fluctuates concurrently in some measure with the varying unhealthiness of individual jails.

The Gangetic Provinces and Oudh group maintained its high standard of health, as compared with the other geographical groups of the Bengal Presidency. The jails of the Central Provinces are still characterised by their very high average mortality, which greatly exceeds that of every other group. The mortality from dysentery and diarrhœa alone, in these jails was in excess by over 10 per 1,000 of the total mortality of the Gangetic Provinces and Oudh jails. The high standard of health of the Rohilkund and Meerut group attained in 1883 has declined year by year, and instead of a ratio of mortality of 18·26 per 1,000, the high average of 33·53 per 1,000 was reached. So also with the jails of Agra and Central India, the ratio of mortality has increased year by year since 1884, when it stood at 19·89 per 1,000 to 41·28 in 1887. Sickness and mortality diminished in the jails of Lower Bengal, and increased to a very considerable extent in the jails of the Punjab, which show a much higher ratio of mortality than those of the Bengal and Assam jails.

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged in Groups in accordance with their Geographical Positions) from 1877–81, 1882, 1883, 1884, 1885, 1886 *and* 1887.

Groups.		Average Strength.	Ratio per 1,000.					
			Admissions into Hospital.	Daily Sick.	Deaths from			Difference between Average Mortality and Year's Mortality.
					Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam	1877–81	14,788	1,519	50	7·43	31·63	67·50	—31·86
	1882	13,327	1,693	54	8·25	25·44	59·95	
	1883	12,414	1,630	53	4·03	22·64	52·52	
	1884	12,250	1,586	55	4·24	25·06	57·71	
	1885	12,148	1,642	58	7·24	28·73	60·50	
	1886	12,076	1,448	49	4·14	17·97	43·97	
	1887	10,157	1,513	49	1·38	15·75	35·64	
II.—Gangetic Provinces and Oudh	1877–81	22,769	695	25	3·21	13·98	33·29	— 9·00
	1882	13,515	724	28	3·19	14·36	33·70	
	1883	16,846	616	23	3·32	8·67	25·76	
	1884	15,822	629	24	0·88	8·91	21·05	
	1885	15,347	678	25	5·08	8·93	27·63	
	1886	15,949	612	24	0·56	7·40	21·44	
	1887	14,739	662	25	2·58	8·89	24·29	
III.—Central Provinces (excluding Jubbulpore and Saugor)	1877–81	3,002	983	36	11·39	26·11	69·88	+ 2·08
	1882	2,833	1,106	48	4·24	49·42	89·66	
	1883	2,609	1,003	41	4·22	60·56	88·54	
	1884	2,259	902	34	0·44	22·13	45·15	
	1885	2,285	938	38	15·32	29·76	68·71	
	1886	2,458	1,078	39	10·17	32·14	67·13	
	1887	2,571	852	30	19·06	28·78	71·96	
IV.—Agra and Central India	1877–81	5,338	1,063	49	2·89	17·16	51·33	—10·05
	1882	4,513	763	28	0·89	6·65	27·92	
	1883	4,359	556	21	2·75	6·19	21·56	
	1884	4,224	640	24	0·24	7·34	19·89	
	1885	3,835	779	33	—	17·47	38·07	
	1886	3,651	892	32	—	12·87	33·69	
	1887	3,464	926	31	7·22	19·91	41·28	
V.—Rohilkund and Meerut	1877–81	9,072	935	40	0·35	15·30	37·59	— 4·06
	1882	7,187	1,007	38	—	7·65	25·46	
	1883	6,627	753	31	—	3·62	18·26	
	1884	6,054	1,074	34	1·82	7·93	25·60	
	1885	5,321	1,209	41	—	10·34	28·38	
	1886	5,142	1,051	37	0·97	8·36	29·17	
	1887	5,100	920	34	0·59	8·24	33·53	
VI.—Punjab	1877–81	14,180	1,674	51	2·38	31·64	88·13	—43·70
	1882	13,115	1,546	45	—	15·25	41·63	
	1883	12,128	951	27	—	6·18	29·11	
	1884	11,268	1,131	27	—	7·10	23·04	
	1885	10,468	1,000	25	—	4·68	27·13	
	1886	10,752	1,082	26	—	8·09	28·46	
	1887	11,275	1,158	26	6·21	13·12	44·43	

The improvement in the health of prisoners confined in the jails of Bengal Proper has been most marked, and the high average mortality of former years from dysentery and diarrhœa has diminished by 50 per cent. As compared with the previous year, there was a slight increase in sickness, the admissions to hospital being in the ratio of 1,513 per 1,000 against 1,323 in 1886; but a considerable fall in the mortality (from 38·30 to 35·64), and the death-rate from all causes is the lowest yet recorded. Admissions for fevers were more numerous than in the previous year, but the mortality was less. The death-rate from bowel complaints (15·39) is the lowest on record, and the admissions from this cause were fewer than in any year since 1879.

Of the seven large jails with an average strength of over 500 prisoners, Rajshahai was the most unhealthy, and recorded a death-rate of 44·07 per 1,000 of average strength. Bhagalpur Central jail comes next with a mortality of 41·58 per 1,000, then Midnapore with 35·23, Dacca 32·42, Alipore 31·11, Presidency 15·36, and the Buxar jail with a mortality ratio of only 11·51 per 1,000, including 3·45 per 1,000 from cholera. Rajshahai still heads the list as regards mortality, which, however, was greatly less than in the previous year, when it stood at 90·19 per 1,000. The chief causes of mortality in that jail were dysentery and diarrhœa, anæmia, and the cachexia resulting from malarial fevers. The Presidency and Buxar jails, with their low average mortality of the previous year, show a further decline in the death-rate, which is highly satisfactory. Buxar jail, with an average strength of 869, an admission rate of 705, and a total mortality of only 11·51, including deaths from cholera, is the nearest approach in Bengal to a healthy jail community. The chief causes of mortality in the large jails noted, with the exception of the Alipore jail, were dysentery and diarrhœa. In the Alipore jail, respiratory diseases were the chief cause, and dysentery and diarrhœa and fevers in a slightly less ratio. Buxar Central jail, with the lowest mortality from all causes, had 3 deaths from cholera, the Alipore jail 2 deaths, and the Bhagalpur Central jail 1 death, from the disease.

Of the jails with an average strength of over 100, the Rungpore jail, with an average population of 220, recorded a death-rate from all causes of 100 per 1,000, including 27·27 per 1,000 from cholera. The total number of deaths in the Rungpore jail was 22, of which 8 were due to dysentery and diarrhœa, 6 to cholera, and 5 to respiratory diseases, including 2 from pneumonia. Dinagepore jail had a death-rate of 84·51, and of the total 12 deaths in this jail, 3 were due to cholera, 3 to diarrhœa, and 3 to apoplexy. The ratio of mortality in the Ranchee jail was 70·92, in the Purneah jail 63·64, in the Hooghly jail 60·77, in the Backergunge jail 52·94, in the Mymensingh jail 39·53, in the Gya jail 39·37, in the Soory jail 36·04, in the Patna jail 32·68, in the Chupra jail 32·61, and in the Cuttack jail 32·26. In all these jails dysentery and diarrhœa were the chief causes of mortality. Cholera, as already noted, caused 6 and 3 deaths respectively in the jails of Rungpore and Dinagepore, but in no other jail of those noted was there a death from this cause in 1887. Only 1 death from scurvy occurred among the prisoners confined in Bengal jails. The exceptionally high admission-rate, from this cause, of 283·7 was recorded at Ranchee, where the death occurred. The death-rate from anæmia and debility in the Ranchee jail was likewise high. No death was recorded in the Tipperah jail, although in the previous year the death-rate in that jail was 103·23. Of the minor jails, with an average strength of under 100 prisoners, none with the exception of the Khoolna jail shows an exceptional rate of mortality. There were 7 deaths, with an equivalent death-rate of 212·12 in that jail with an average annual strength of 33 only. Of the 7 deaths, 3 were due to dysentery, 2 to heart-disease, 1 to peritonitis, and 1 to malarial cachexia, complicated with dropsy.

There has been a gradual increase in the death-rate of the North-Western Provinces jails of late years, and the death-rate of the year under review (27·68) is the highest since 1880. The ratio of deaths from dysentery and diarrhœa (8·35) has likewise increased in a degree proportionate to the increase in the rate from all causes.

Eleven jails show an average strength of over 500, but of the 11 only 1, the Meerut jail, recorded an exceptional mortality of 61·19. Of the total number of deaths in this jail, 16 were due to pneumonia, 3 to fevers, 3 to anæmia and debility, 2 to phthisis, 2 to dysentery and diarrhœa, 2 to pulmonary congestion, and 1 to meningitis. Fifty per cent. of the deaths were returned as pneumonia, but it is not stated whether this pneumonia was the simple or uncomplicated disease, or merely a complication of continued fever. The death-rates of the Allahabad District, Agra Central and Lucknow Central jails were respectively 38·54, 39·20, and 36·50. Sitapur jail, with an average strength of 541, had the remarkably low death-rate of 3·70 only per 1,000, and the Fatehgarh Central prison, with an average population of 938, returned a

death-rate of only 8·53 per 1,000 of average strength. With the exception of the Meerut jail, the central and large district jails of the North-Western Provinces maintained a fair standard of health, and some of these jails were particularly healthy. The daily average sick ranged from 33·4 in the Agra Central to 7·8 in the Allahabad Central prison, and the admission-rate from 870 in the Meerut jail to 291 in the Allahabad Central prison. Etah jail, with a death-rate of 99·42, recorded the highest mortality among jails with an average strength of over 100 and not exceeding 500. Of the total 17 deaths in this jail, 7 were returned as pneumonia, 3 as cholera, and 3 as dysentery. The large percentage of deaths from pneumonia is worthy of note, as the uncomplicated disease is rare amongst the free community, especially in the hot months, when the disease was present in the jail. The death-rate of the Banda jail was 80·32, due chiefly to dysentery and diarrhœa and fevers; the Gorakhpur jail death-rate was 66·25, Bulandshahr 61·07, Aligarh 55·17, Cawnpore 46·05, Saharanpur 43·69, Kheri 42·25, Hamirpur 41·92, Moradabad 36·70, Fyzabad 34·16, Mirzapore 33·71, Shahjahanpur 32·05, and Agra District jail 31·45. The chief causes of mortality in the Gorakhpur, Bulandshahr, Cawnpore, Hamirpur, Fyzabad, Mirzapore, Shahjahanpur, and Agra District jails were dysentery and diarrhœa, and in Aligarh, Saharanpur, and Kheri, respiratory diseases and bowel complaints. Fevers were the chief causes of mortality in the Moradabad jail. The admission-rate, 4052·6, of the Etah jail was exceptionally high, and far in excess of any other male convict prison in India. Allahabad Central prison recorded an admission-rate of 291·8 and a daily sick-rate of 7·8 as compared with the large totals of 4052·6 and 81·9 in the most unhealthy Etah jail. Of the three minor jails, Dehra Dun returned 3 deaths, Almorah none, and Muzaffarnagar 3, including 1 from hydrophobia. There was no death from scurvy in the jails of the North-Western Provinces, although six jails returned cases of the disease. Cholera appeared in 10 jails of the province, and of the total 52 deaths 39 occurred in central jails; 19 in Lucknow, 14 in Agra, and 6 in Benares Central prison. Three deaths from this cause increased the high ratio of mortality from other causes in the Etah jail. Pneumonia was the cause of 3 deaths in the Saharanpur jail, and there were 6 deaths from this cause in the Bareilly district jail, and 10 in the Bareilly and 7 in the Agra Central prison. The cases were returned as simple uncomplicated pneumonia.

There was an increase in the sickness and mortality of the Punjab jails, as compared with the previous year, and the death-rate (44·43) was the highest since 1881. The great increase in the mortality was due to cholera and to the greater fatality of bowel complaints and respiratory diseases, chiefly pneumonia. The admission-rates from intermittent, remittent, and simple continued fevers, diarrhœa, and respiratory diseases, were considerably in excess of those of 1886. August was the sickliest month, the average admission-rate being 173·2, as compared with 105·5 of the previous year. The immunity from cholera of the jails of the province for the previous five years was not maintained. A sharp and severe outbreak occurred in the Lahore Central jail, and the Lahore District and female jails each returned cases. The Umballa, Rawal-Pindi, Rohtak, and Kohat jails were also affected to a less extent. Of the 79 cases of cholera admitted 70 proved fatal, or 88 per cent. of deaths to admissions. Sixty-five of the 70 deaths occurred among the prisoners of the Lahore jails, 2 at Rawal Pindi, 2 at Rohtak, and 1 at Kohat. One death from small-pox was recorded in the jails of the province, 5 from cerebo-spinal fever, 2 from enteric fever, and 1 from typhus.

Seven of the Punjab jails recorded an average strength of over 500 prisoners, including the Lahore Central and Chinawan jails, which returned an average strength of 1,666 and 1,260 respectively. There was a general increase in the average mortality, and in the two large central jails noted, the increase is equal to 71·86 per 1,000 in the case of the Lahore Central jail, and 16·12 per 1,000 in the case of the Chinawan jail. Cholera was extremely fatal in the Lahore Central and in the Lahore Female jail, the mortality from this cause alone being 35·41 and 46·73 respectively. The Lahore District jail had a mortality of 57·09, and the Delhi jail 35·64 per 1,000. In contrast with the high ratios of mortality mentioned, the Rawal Pindi jail had a death-rate of only 10·77, Peshawar jail 11·86, and Mooltan jail 14·68 per 1,000 of average strength. Of the jails with an average population of under 500 and over 100 prisoners, the Umballa jail had a death-rate from all causes of 71·82 against 28·13 of the previous year, the Lahore Female jail 56·07 against 13·61, Bannu jail 54·55 against 42·94, Amritsar 45·33 against 37·15, Hissar 43·17 against 14·78, and Rohtak 31·63 against 9·35 in 1886. Of the minor jails, Abbottabad showed an increase of 20·13 in the mortality ratio as compared with that of 1886. In the Lahore Female jail the

admission-rate reached the large figure of 4,028 per 1,000 of average strength, and the admission-rate was also excessive in the Amritsar, Bannu, Muzaffargarh Chinawan, and Lahore District jails. The Lahore Female, the Muzaffargarh, and Amritsar jails, each recorded a daily sick-rate of over 50 per 1,000 of average strength. Six jails, including all the Lahore jails, returned cases of scurvy; and the average number of admissions for anæmia and debility in the Lahore Central prison was greatly in excess of that of every other jail in the province. There was one death from small-pox in the Rawal Pindi jail. The increase in the sickness and mortality in the Punjab jails was due to cholera, dysentery and diarrhœa, and respiratory diseases, all of which were more prevalent and fatal than in the previous year.

With an increase in the average population of the jails of the Central Provinces, there was a decrease both in the admission and daily sick-rates. The death-rate from cholera (14·17) was double of that of 1886, and with the rise in the rate from this cause there was an increase in the general mortality. The average mortality in the jails of the Central Provinces was very high (67·93) and about double the average of the jail death-rate of all India.

The three large jails, Jubbulpore, Nagpur, and Raipur, each with an average strength of over 500 prisoners, returned a death-rate of 67·35, 62·05, and 34·43 respectively, against 66·06, 97·59, and 61·86, in 1886. The increased general death-rate of the year was due to the excessive mortality in the Sambalpur jail with an average strength of 198, and in the Betul jail with an average strength of 69 only. The Sambalpur jail returned a ratio of mortality of 242·42 from cholera alone, and 126·27 from all other causes, a total death-rate of 368·69. There were 73 deaths in the Sambalpur jail: 48 from cholera, 22 from dysentery and diarrhœa, 1 from pneumonia, 1 from bronchitis, and 1 from scurvy; and 21 in the Betul jail, 14 from epidemic jaundice, 3 from dysentery, 2 from remittent fever, and 2 from anæmia and debility. The only other jails, which showed a ratio of mortality in excess of the average for all India, were Seoni jail, with 50·00, and Chanda jail, with 42·25. In the case of Seoni, the excess death-rate was due to cholera. Four deaths from scurvy occurred in the jails of the Central Provinces, 3 in the Nagpur, and 1 in the Sambalpur jail. There was no death from small-pox. Dysentery and diarrhœa were the chief causes of mortality, and of the total 66 deaths in the Jubbulpore jail, 42 were due to this cause. An outbreak of "epidemic jaundice" occurred in the Betul jail, caused, it is stated, by the severity of the weather and the want of proper means of protecting the prisoners against the cold. There were 14 deaths from this cause among an average strength of 69 prisoners. Epidemics of this nature have been described as occurring in England and elsewhere, and the latest occurrence of the kind was noted by Dr. Russell, Health Officer of Glasgow, who surmised that the outbreak he recorded was due to insanitary surrounding, a vitiated atmosphere, and causes distinctly remediable. Another cause has been suggested in the use of food-grains which have sprouted, or have undergone fermentation and other changes. Eighty prisoners in a jail of the North-West Provinces were poisoned in the current year by *kodo* (Paspalum scrobiculatum), which, when in a diseased condition, had been issued as an ordinary prison ration.

While the average strength of the Berar jails was less, there was a marked increase in the admission, daily sick, and death rates, as compared with the previous year. The average death-rate (26·76), however, was 8 per 1,000 under the general average for the jails of all India. There were 25 deaths, including 8 from cholera in the jails of Berar, against 12 of the previous non-cholera year. The Amraoti jail, with an average strength of 336 prisoners, had a death-rate of 23·81 from cholera and a total death-rate of 38·69, and the minor jail of Yeotmahal, with an average population of 38, only returned 2 deaths, 1 from diarrhœa, and 1 from pneumonia, equal to a total death-rate of 52·63. The average ratio of admissions from ague was comparatively high in the Akola jail, and from dysentery and diarrhœa in the Amraoti jail.

Although cholera was more prevalent and fatal in the jails of Lower Burma, there was a decrease in the mortality from all causes (from 61·55 in 1886 to 59·35 in 1887), and a satisfactory and sensible diminution in the mortality from dysentery and diarrhœa. Dysentery and diarrhœa and cholera were the chief causes of mortality, the ratio being 19·61 against 22·26 in 1886. Cholera was more prevalent and fatal than in any year since 1878, but was confined to the Moulmein and Akyab jails, which returned 106 of the 109 total deaths from this cause. Four jails returned cases of scurvy, but there was no death from the disease. There was one death from small-pox, in the Rangoon jail. Dysentery and diarrhœa and fevers were the principal causes of sickness.

The Moulmein jail heads the list with the highest death-rate, 171·77 against 54·80 or 202 deaths against 73 in the previous year. There were 91 deaths from cholera and 54 from dysentery and diarrhœa, and the death-rate excluding 77·38 per 1,000 from cholera, reached 94·32 per 1,000, an excessive mortality. The incidence of cholera in the Akyab jail raised the death-rate to 90·02, of which 36·50 per 1,000 were due to the epidemic of cholera in January. Dysentery and diarrhœa were, as usual, very fatal in the Akyab jail. Rangoon jail, with its large average population of 2,897, shows a death-rate of 49·02, of which ·69 was due to cholera. Bassein jail shows a death-rate of 37·04 and the Toungoo jail, 35·48. The highest average daily sick-rate was 71·1 in the Rangoon jail, 65·7 in the Akyab jail, 53·6 in the Moulmein jail, and 51·6 in the Toungoo jail. The minor jail of Myanaung shows a high average sick, but a comparatively low death-rate, and Minbu, with its average strength of 7, recorded 2 deaths—1 from fever and 1 from respiratory disease.

The average strength of the jails of Assam was less than in any year since 1877, and the mortality (34·17) lower than yet recorded, with the exception of 1882. There were no admissions or deaths from cholera in the jails or lock-ups of Assam in 1887, and dysentery and diarrhœa were less fatal than usual. The admission-rate (19·90 per 1,000) was slightly over that of the previous year, while the daily sick-rate (58) was lower.

The Telikhal, Sylhet, and Tezpur jails each recorded the high admission-rate of 2938·6, 2584·4, and 2,234·0 respectively. Telikhal jail shows an admission-rate from dysentery and diarrhœa of 1087·7, and Tezpur and Gauhati jails of 1184·4 and 924·1 from ague alone. The chief causes of admissions were fevers, dysentery and diarrhœa, anæmia and respiratory diseases; while the chief causes of mortality were dysentery and diarrhœa, and in a less degree fevers and anæmia and debility. The high admission-rate of 268·2 per 1,000 from remittent and simple continued fevers was noted in the Sylhet jail. The remarkable immunity from cholera of the jails and lock-ups of Assam is worthy of note. Sylhet jail, and some locks-up, reported cases of scurvy, but there was no death from this cause, nor from small-pox. Only one, the Cachar jail, of the larger Assam prisons returned an excessive death ratio. There were 9 deaths in that jail with a ratio of mortality of 79·65. Sibsagar, a minor jail with an average strength of 68 only, had also 9 deaths, including 7 from dysentery and diarrhœa, the total death-rate being 132·35 per 1,000.

The average strength of the jails of the Madras Presidency was less than in any year since 1877. Sickness has steadily decreased, and the admission-rate (654 per 1,000) is the lowest yet recorded. The mortality ratio (22·12), on the other hand, is the highest since 1883. There was an increase in the death-rate from dysentery and diarrhœa, phthisis, beri-beri, phagedæna, and from general causes. There was 1 death from cholera in the Bellary jail; and 2 from small-pox, one in the Calicut and the other in the Coimbatore central jail. The mortality ratio, for the Madras jails generally, was 12·03 under the general average for the jail population of all India. Of the total number, 134 deaths, 36 were due to dysentery and diarrhœa, 16 to circulatory diseases, chiefly diseases of the heart, 15 to phthisis, 14 to beri-beri, and 14 to phagedæna.

Of the five principal jails, recording an average strength of over 500, only two show a mortality of over 30 per 1,000, namely, the Rajamundry Central jail, 61·22, and the Coimbatore Central jail, 30·41 per 1,000. Trichinopoly Central jail, with an average population of 783, recorded the low death-rate of only 3·83 per 1,000. The chief causes of mortality in the Rajamundry jail were beri-beri, heart disease, phthisis, dropsy, dysentery and diarrhœa, and dysentery and diarrhœa in the Coimbatore Central prison. Cannanore, with an average strength of 363 prisoners, had a death-rate of 38·57 with circulatory diseases as the chief causes of mortality. The Tanjore jail, with an average annual strength of 184, shows a mortality ratio of 38·04, due chiefly to dysentery and diarrhœa. Of the minor jails, Berhampore with an average strength of 99, and Cuddapah, with an average strength of 94, each recorded 5 deaths, and a death-rate of 50·51 and 53·19 respectively. The highest admission-rate was for ague in the Rajamundry Central jail; and it is noticeable that no case of ague was returned from the Mangalore jail, in which all fevers were classed under the head of remittent or simple continued fever, the admission-rate for such fevers being the highest of all the jails of India. Such a system of classifying the simple intermittent fevers of the country tends to complicate the statistical record.

There has been a progressive annual decrease in the jail population of the Bombay Presidency, and the average strength in 1887 was 50 per cent. less than it was ten years ago. Sickness has diminished to a great extent and the admission, daily sick, and

death rates are the lowest on record. The death-rate was 19·06 as compared with 30·44, and the actual number of deaths 108, against 206 of the previous year. There was a decline in the mortality from respiratory diseases, dysentery and diarrhœa, anæmia and debility, phthisis and scurvy; and although cholera was the cause of 7 deaths, the general death-rate was the lowest hitherto recorded, and 15 per 1,000 under the average for the year of the jails of all India. There was no death from small-pox.

Kaira jail with a death-rate of 105·26, the Bombay House of Correction with 51·47, the Shikarpur jail with 42·00, and the Thana jail with 28·32, were the exceptions to the high standard of health of the Bombay jails. The high death-rate of the Kaira jail was due to a sharp outbreak of cholera with 6 deaths, and to dysentery and diarrhœa; that of the Shikarpur jail, to dysentery and diarrhœa, pneumonia, scurvy, and cerebro-spinal fever; and that of the Thana jail to dysentery and diarrhœa and remittent fever. Of the 14 deaths in the Bombay House of Correction, 5 were due to dysentery and diarrhœa, 3 to pneumonia, 1 to septicæmia, and 1 to peritonitis. Of the total 108 deaths, 39 were due to dysentery and diarrhœa, 22 to respiratory diseases, 9 to fevers, 7 to cholera, 6 to anæmia and debility, and 3 to scurvy. The Yerrowda jail, with an average population of 979, shows a death-rate of only 4·09, or an actual mortality of only 4: 2 deaths from dysentery and diarrhœa, 2 from pneumonia; and the Bombay common jail with an average annual strength of 227, shows also the low death-rate of 4·41. The minor jail at Aden, with an average annual strength of 59, had an admission-rate of only 67·8 per 1,000. There were no deaths in this jail in 1887.

The health of the prisoners in the Convict settlement at the Andamans was less satisfactory than in 1886, and the admission and death-rates (1,927 and 23·03 per 1,000) were higher than in any year since 1882. There were 273 deaths against 242, although the average population of the settlement was much the same. The increase in sickness was due to fevers, dysentery and diarrhœa and phthisis; and in mortality to dysentery and diarrhœa, phthisis, and in a less degree to anæmia and debility. There were no deaths from scurvy, and the admission-rate from this cause was only ·4. The settlement enjoyed the usual immunity from cholera and small-pox.

General remarks.

The general health of the jail population of India was less satisfactory than in the previous year, and there was an increase in the death-rate from cholera and dysentery and diarrhœa. Both the Bengal and Madras jails had a higher, while the Bombay jail had a much less rate of mortality than in 1886. There was a great increase in the mortality in Punjab jails, a rise in the death-rate of the jails of the North-Western Provinces and Oudh, and a slight fall in the rate in the jails of Bengal Proper. The tendency to a rise in the death-rate generally was marked in the jails of the Central Provinces, in which the ratio of mortality remained exceptionally high, and affected the Berar jails in which an exceptional increase was noted, the mortality being double that of the previous year. Lower Burma jails and those of Assam, were healthier than in 1886, although the death-rate of the former was exceptionally raised by the incidence of cholera in an epidemic form in the Moulmein jail. The death-rate of the Assam jails was the most favourable on record, and no death from cholera occurred in the jails of that province in 1887. The jails of Bombay, Madras, Berar, and North-Western Provinces were the most healthy; and also, in consecutive order, those of the Central Provinces, Lower Burma, Punjab, Lower Bengal, and Assam, the most unhealthy. The actual death-rate ranged from 19·06 per 1,000 in the jails of the Bombay Presidency to 67·93 in the jails of the Central Provinces, in which also the highest death-rate, 368·69 per 1,000, in any individual jail occurred.

General Population.

General remarks.

The birth-rate exceeded 40 per 1,000 in only two provinces, Berar and the Central Provinces, but reached 38 per 1,000 in the North-Western Provinces, the Punjab, and the Presidency of Bombay. In the remaining provinces it varied from 14·48 in Coorg to 31·0 in Madras. The Bengal Presidency is conspicuous with a low birth-rate of 19·35 per 1,000. The birth-rate exceeded the death-rate in eight of the 11 provinces; in Bombay by as much as 11·51 per 1,000; while the death-rate was in excess of the birth-rate in three provinces, Bengal, Berar, and Coorg. In all the provinces, except Coorg and Mysore, in which the statistics are quite unreliable, there is a considerable difference between the maximum and minimum birth-rates in any one district, the province of Bengal Proper being again the most noticeable with a maximum of 50·21 and minimum of 0·66.

A similar want of uniformity appears in the death-rates returned by the districts in each province, again excluding Mysore and Coorg. In the North-Western Provinces they vary from a maximum of 71·59 to a minimum of 23·37, and in the Punjab between 62·0 and 15·0; and the nearest approach to uniformity and a true result is shown by Berar with a maximum of 54·3 and minimum of 37·3. Cholera is credited with the death of 5·5 per 1,000 of population in Berar and 4·54 in the North-Western Provinces. Small-pox was most prevalent in Mysore (1·61 deaths per 1,000), the Punjab, Madras, and Coorg. The highest mortality from fevers took place in the North-Western Provinces (25·76), the Punjab (23·78), and Central Provinces (19·20 per 1,000).

The following statement shows the deaths recorded amongst the general population in each month throughout the year in the different provinces:—

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of Deaths per 1,000 of Population.	
														1887.	1886.
Bengal	148,714	101,811	105,767	126,348	140,829	112,624	137,112	138,979	112,624	135,926	147,957	145,349	1,552,528	23·46	21·99
Assam	9,153	7,187	7,252	7,998	9,895	9,914	9,777	8,830	8,587	9,926	10,845	11,571	111,015	24·52	27·77
North-West Provinces and Oudh.	93,432	77,837	88,270	110,099	146,227	159,559	153,640	156,063	150,238	175,048	149,698	121,633	1,581,739	35·66	33·27
Punjab	30,807	33,597	38,554	44,018	50,566	44,437	41,907	46,161	71,216	101,715	74,993	59,913	646,384	34·31	26·60
Central Provinces	19,388	17,602	18,293	19 256	22,864	21,956	24,649	29,777	32,901	32,228	26,046	23,365	288,325	32·70	33·24
Berar	6,756	6,408	6,298	6,109	5,714	5,790	10,156	22,079	20,353	12,632	9,037	7,415	118,797	45·3	36·7
Lower Burma	5,051	3,914	3,697	4,024	3,871	4,740	6,055	5,959	5,631	5,457	5,421	5,285	59,115	16·18	15·54
Madras Presidency	53,422	46,050	47,437	41,510	44,918	42,370	48,896	49,888	49,761	50,627	53,863	76,033	604,775	21·6	19·7
Bombay „	33,013	30,289	32,165	33,411	35,051	39,695	43,614	46,690	43,420	40,543	39,370	38,050	455,261	27·67	23·17
Mysore	6,881	6,410	6,563	6,145	6,262	6,802	6,877	6,088	5,775	6,175	5,808	6,288	76,074	18·59	17·18
Coorg	256	275	236	280	344	394	362	298	281	268	211	256	3,461	19·41	20·33
Total	415,413	331,380	354,532	399,198	466,541	448,269	483,045	509,962	500,787	569,990	523,249	495,158	5,497,474		

The registration of vital statistics in Bengal shows as yet no improvement. Here and there in certain districts an attempt to obtain more accurate figures may be visible, but the general result is still as imperfect as ever, and, indeed, if anything, seems to be retrograding. The registration of births, which was confined in 1886 to only 45 towns, was extended in 1887 to a hundred towns; but the figures for these towns as a whole do not show the least improvement, the average birth-rate falling from 21·04 in 1886 to 19·35 per 1,000 in 1887 with extremes varying from ·66 to 50·21. In Burdwan, where birth registration has been carried on for some time past, the ratio fell from 22·39 to 13·46; at Dacca from 16·26 to 12·22; at Patna from 21·60 to 19·49; at Mozufferpore from 19·34 to 8·28; at Chupra from 12·75 to 7·19. The death-rate of this province in 1887 stood at an average of 23·46 per 1,000 made up of ratios varying from 12·53 in Mozufferpore to 35·31 in Monghyr, and 42·17 in the suburbs of Calcutta, and can hardly be looked upon as correct. Incomplete registration is evident in both the town and rural circles; in the former the death-rate fell from 28·98, the mean of the preceding 5 years, to 24·12 in 1887, and this again ranged between a minimum of 5·04 and a maximum of 51·16; while in the latter the mean mortality was at the rate of 23·44 per 1,000, and the extremes were 12·45 and 35·59. Even in those municipalities where the Compulsory Registration Act is in force, the results in regard to both births and deaths with a few exceptions were very poor.

In the city of Calcutta deaths were recorded at the rate of 25·34 per 1,000. This low ratio is probably due to the fact that the majority of working men and traders who carry on business in Calcutta are outsiders, and either lodge beyond the town limits, or leave the town when sick. In the port of Calcutta the mortality was about one-half of what it was in the preceding year, but the proportion contributed by cholera was nearly the same in both years.

The registration of vital statistics in the North-Western Provinces and Oudh is not yet satisfactory, for in some places the records of both births and deaths are decidedly defective; but the average results for the provinces as a whole are encouraging, and seem to be nearer the truth than in most divisions of the country. The total births during the year amounted to 1,708,735, yielding a ratio of 38·74 per 1,000 of population, which, although higher than that of the preceding year (37·62), was less than the ratios recorded in 1885, 1884, or 1883. The excess of male over female births in the province was a little above 12 per cent., but in several districts the percentage rose to 20 and upwards. This disproportion is supposed to have been due to many female births having escaped registration. On the other hand, there are 1,581,739 recorded deaths, or at a rate which fell short of the birth ratio by 2·88 per 1,000. But in 19 of the 49 districts, the deaths were in excess of the births, and in three of these especially this excess assumed very high proportions, ranging between 21 and 25 per 1,000. In one of these, however, viz., the unhealthy district of the Tarai Pergunnahs, the high rate of 56·89 was not quite unusual, as the mean of the previous five years stood at 51·63; but in the other two districts of Jalaun and Jhansi the mortality rose to 66·18 and 71·59 respectively, against 34·95 and 36·95 in the preceding quinquennium. In 20 out of the 106 towns in the province, the mortality was very excessive, ranging between 50·22 and 85·43 per 1,000. As usual, the largest proportion of the mortality was among children under one year. Viewed according to monthly distribution the largest number of deaths occurred in June and October and the lowest number in February.

The vital statistics collected in the Punjab during 1887 do not indicate any improvement in registration. The birth-rate, 38·88 per 1,000, was somewhat lower than in 1886 (39·47); but it exceeded the rate for 1885 (38·84) by a fraction, and was identical with the average birth-rate of the quinquennium, 1881–85. The variation in the district ratios was also somewhat greater than in the preceding year. The minimum (12·41) was, as usual, at Simla; but, omitting this station, where the proportion of male to female population is very great, and the two frontier districts of Peshawar and Dera Ghazi Khan, where registration is specially defective, the birth-rate varied from 24·69 in Kohat to 51·71 in Sialkot. In 1886, the extremes, omitting the three districts noted above, were 27·47 and 50·28. The average death-rate of the province (34 per 1,000), owing especially to greater unhealthiness during the last three-quarters of the year, was much higher than the ratio of 1886, as well as the mean mortality of the preceding five years; but the district details show that, although in all of them the mortality was higher than in 1886, registration is still defective in several of them. The districts which had the highest mortality were Delhi, Gurgaon, Karnal, and Rohtak, with ratios ranging between 45 and 62 against 27 and 40 in the preceding year. In the villages situated on the Western Jumna Canal, in the Delhi District, also the death-rate rose to 61 per 1,000 against 42 in 1826; and in the 49 municipalities of the province the death-rate rose from 33 in 1886 to 46 per 1,000 in 1887. The highest mortality occurred in the month of October and the lowest in February. There was an increased mortality in 1887 under every heading except injuries.

The birth records of the Central Provinces for 1887 show some improvement over the results of the previous year, the average ratio for the province having risen from 37·79 per 1,000 in 1886 to 40·20 in 1887. The birth-rate in the different districts ranged between 31 and 50 per 1,000. The excess of boys over girls among the children born in the province during the year was a little above 6 per cent. The deaths amounted to 288,325 or at the rate of 32·70 per 1,000 against a mean of 31·86 for the preceding five years. In towns the mortality was at the rate of 32·96 per 1,000, and the birth-rates were 8·91 per 1000 lower than in the province as a whole. These results, however, are still far from perfect. In many districts and towns the statistics admit of improvement and several civil surgeons are stated to have "considered the figures returned for one or more months doubtful."

The imperfection of the vital statistics recorded in Berar, specially in its urban circles, is again apparent in 1887. The birth-rate of the province amounted to 40·5 per 1,000 of population and the district ratios varied from a minimum of 34·4 in Wun

to a maximum of 45·6 in Buldana. In the towns the average birth-rate was 39·2, made up of extremes ranging between 16·9 and 51·5. In the rural circles the births were recorded at an average rate of 40·6 per 1,000. The total deaths of the province numbered 118,797, which yielded a ratio of 45·3 per 1,000 against 36·7 in 1886, 34·0 in 1885 and 24·6 in 1884. Although the ratio was not so high as in 1883 (51·3), there is no doubt that 1887 was a very unhealthy year in Berar. All the principal diseases, contributed in a larger proportion to the mortality of the year than in 1886.

The Report for 1887 furnishes further evidence of the continued backward state of the vital statistics in Lower Burma. An average birth-rate of only 21·74 per 1,000 and the death-rate so low as 16·18 can hardly be taken to represent the truth, especially when it is seen that the district ratios which formed the basis of these averages varied in the case of births from a minimum of 8·95 to a maximum of 35·79, and in the case of deaths from 7·77 to 22·13. Even in towns where there is greater facility for collecting such statistics the results were equally unsatisfactory, the average annual birth-rate being 23·27, and the death-rate 27·17. Rangoon, the chief city of the province, recorded a birth-rate of only 15·14 and a death-rate of 27·13.

The defects which characterised the vital statistics of the province of Assam in former years were still more palpable in the year under review, especially in the districts comprised in the Brahmaputra valley. Owing to some improvement in the Surma valley and the Khasi hills, the provincial birth-rate rose from 27·55 per 1,000 in 1886 to 28·59 in 1887, but in the Brahmaputra valley the ratio fell from 27·61 to 26·59. Here all the districts, with the single exception of Darrang, showed more or less diminution in the number of the recorded births, as compared with the previous year, and three out of the six districts exhibited a great preponderance of deaths over births. In the Sadr and sub-divisional towns, where, in spite of compulsory registration being in force, the respective birth-rates were only 23·91 and 23·90 per 1,000, the defects are still more evident. In the former group the ratios varied from a minimum of 4·49 to a maximum of 39·70, and in the latter from 4·02 to 53·33. Better results were secured in the towns of Tezpur (38·14), Dibrugarh (39·70), Mangaldai (31·79), Karimganj (41·86), and Sunamganj (53·33). In the tea gardens, as a whole, where the figures are compiled by a more intelligent agency, the result (28·09 per 1,000), according to the half-yearly returns cannot be considered to be wholly reliable. In regard to mortality, the statistics show a decrease of the death-rate in all the districts, so that in the province as a whole it fell from 27·77 in 1886 to 24·52 in 1887. This might have been due, as alleged, to some extent to the comparative dormancy of cholera in the Brahmaputra valley in the year under review. Still a comparison of these figures with those of some of the advanced provinces throws great doubt on their accuracy, particularly as the district ratios varied from a maximum of 39·56 in Goalpara to a minimum of 17·81 in Nowgong, the intermediate ratios not having exceeded in any case 31·32. The death statistics of the coolies in the tea plantations (36·44 per 1,000), appeared to be nearer the truth.

The progress noticed in the results of birth registration in Madras for 1886, was still more marked in the year under review. The ratio for the Presidency stood at 31·0 per 1,000 of population against 30·4 in the preceding year—the highest birth-rate recorded since the commencement of registration in 1869. This improvement was widespread and progressive throughout the Presidency. The birth-rate of males was 15·9 per 1,000 and of females 15·1, and this preponderance of male over female births is a feature of the statistics collected every year; but is difficult to reconcile with the figures of the census of 1881, which show that in 13 of the 22 districts there was an excess of females over males, and that in the Presidency, as a whole, this excess amounted to over 300,000. In all, 604,775 deaths were recorded in the Presidency. Although this yields a ratio of 21·6 per 1,000, which is higher, not only than the rate for 1886 (19·7), but also than the mean of the preceding ten years (19·2), excluding the famine years of 1877 and 1878, yet judged by the usual rate of mortality in other parts of the country this can hardly be accepted as representing the true death-rate of the Presidency, especially as the variation of the district ratios from 15·8 to 39·4, and of the town ratios from 7·3 to 65·2 affords good ground for the suspicion that in many places a large number of the deaths have escaped registration.

Although the registration of vital statistics in the Bombay Presidency is still far from perfect, there has been a steady progress in the accuracy of the birth statistics collected since 1878. In the year under review the ratio rose to 38·18 per 1,000 against 35·34 in 1886 and 26·63, the mean of decennium 1877–86. Excepting the

city of Bombay and some of the Sind districts, where registration is specially defective, the ratio was nowhere below 31 per 1,000. In the towns the birth-rate rose from 26·56 in 1886 to 27·94 in 1887, and in the rural circles from 36·64 to 39·69. The deaths numbered altogether 455,261, and were more numerous than in any year since 1878, with the single exception of 1885. Of these 238,358 were males and 216,903 females. In the districts, omitting the towns, the death-rate ranged between 11·14 and 40·26, yielding a mean ratio of 27·63 for the rural population of the Presidency; and in the urban circles they varied from 12·47 to 58·46, and gave a mean of 28·05 for the towns as a whole. The registration of deaths is still more imperfect than that of the births, the defect being most evident in Ratnagiri and the five districts of the Sind Division. Viewed according to monthly distribution, the mortality statistics of 1887, like the mean of the ten-year period 1877–86, showed that the greatest number of deaths occurred in August and least in February.

The results of 1887 indicate little or no progress in the registration of vital statistics in Coorg. In the case of births, there was an increase of only 77 in the total number recorded, compared with 1886, resulting in a slight increase in the ratio, viz., 14·48 per 1,000 of population against 14·04 in the preceding year. The deaths, as in past years, greatly outnumbered the births, but in comparison with the total deaths for 1886 fell short by 165, yielding a ratio of only 19·41 against 20·33 in the preceding year.

History of Chief Diseases.

Cholera.

The year 1887 was characterised by a general distribution of cholera over almost the whole of India, and by a greatly increased prevalence in India as a whole, compared with any year since 1877. This is shown by the recorded mortality, the total number of deaths registered from cholera in the year being 488,788, compared with 208,371 in 1886, and 385,928 in 1885, and this figure exceeds the total mortality from this disease in any year since 1877, a "famine" year, when the deaths ascribed to cholera in the whole of India amounted to 635,977. The following table shows the mortality from cholera in the 14 provinces in which deaths are registered, and compares the mortality in 1887 with that of the ten previous years:—

Annual Deaths from Cholera in India, 1877 to 1887.

Province.	Population.	Deaths from Cholera.										
		1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Bengal* - -	66,163,884	155,305	95,196	136,363	39,643	79,180	182,352	99,439	134,421	173,767	118,368	172,578
Assam - -	4,526,959	11,377	6,732	17,415	2,803	5,010	21,055	14,908	22,276	7,753	20,188	7,941
North-Western Provinces and Oudh - -	44,197,869	31,770	22,221	35,892	71,546	25,865	89,372	18,160	30,148	63,457	34,565	200,628
Punjab - -	18,842,264	29	215	26,135	274	5,207	39	190	614	1,936	12	8,804
Central Provinces	8,817,185	3,418	40,985	27,575	330	9,140	11,932	16,255	149	21,868	16,679	12,576
Berar - -	2,630,018	842	34,806	223	1	3,404	3,573	27,897	87	3,683	976	14,396
Rajputana - -	†	60	2,393	918	—	197	1,327	797	1,297	1,695	173	2,612
Central India -	†	926	8,047	2,734	209	581	1,562	1,740	1,018	4,624	290	8,868
Bombay - -	16,454,414	57,228	46,743	6,937	684	16,694	7,904	37,954	13,804	37,287	167	25,711
Hyderabad -	†	7,414	6,696	6	—	1,721	150	1,947	2,479	1,387	499	2,831
Madras - -	28,043,538‡	357,430	47,167	13,296	613	9,446	23,604	36,284	75,476	58,109	12,417	28,359
Mysore - -	4,092,648	2,902	723	14	25	25	893	124	330	2,677	10	832
Coorg - -	178,302	§	49	—	—	3	31	—	—	—	—	3
Lower Burma -	3,653,629	7,276	6,759	1,828	2,638	5,239	7,177	2,185	5,515	7,685	4,027	2,649

* Excluding Calcutta. † Population not known. ‡ Excluding Europeans and Eurasians.
§ Statistics not available.

It will be noticed that there is a diminished recorded mortality from cholera compared with the previous year in only three provinces, viz., Assam, Central Provinces, and Lower Burma; while there is an increase in all other provinces, often of very considerable amount, and especially remarkable in the North-Western Provinces, where the mortality exceeded 200,000, and was more than double that of any other year in the table. In the general distribution of the disease, the year under review resembles very closely 1885; but in the latter year the mortality was greater in the provinces of Southern and Central India, and much less in the Punjab.

The next table exhibits the seasonable distribution of the disease in the different provinces and in India as a whole.

Statement showing the Deaths from Cholera registered in the different Provinces by months during the year 1887.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of Deaths per 1,000 of Population. 1887.	1886.
Bengal	16,662	5,804	8,924	21,068	32,435	21,188	30,566	19,268	5,761	2,946	2,748	5,208	172,578	2·60	1·78
Assam	1,116	343	444	817	1,041	749	245	187	251	448	1,018	1,282	7,941	1·75	4·47
North-Western Provinces and Oudh.	318	385	3,663	11,096	31,528	50,488	41,616	30,780	17,741	8,830	2,965	1,218	200,628	4·54	0·78
Punjab	—	—	—	1	1	91	1,172	3,446	3,136	685	257	15	8,804	0·47	0·0006
Central Provinces	36	8	12	67	335	2,939	3,087	3,006	2,139	806	135	6	12,576	1·43	1·89
Berar	—	—	—	3	7	510	2,273	7,277	3,653	545	82	46	14,396	5·5	0·4
Lower Burma	229	110	301	671	298	100	108	84	151	209	157	231	2,649	0·73	1·10
Madras Presidency	945	679	1,111	483	966	1,445	1,184	2,104	1,718	1,840	2,258	13,626	28,359	1·01	0·4
Bombay Presidency	—	1	16	159	1,840	5,613	6,882	5,123	2,762	1,611	1,072	632	25,711	1·56	0·01
Mysore	—	—	—	1	—	—	—	2	151	337	206	135	832	0·20	0·00
Coorg	—	—	—	—	—	—	—	—	2	1	—	—	3	0·02	—
Total	19,306	7,330	14,471	34,366	68,451	83,123	87,133	71,277	37,465	18,258	10,898	22,399	474,477		

The total mortality presents a minimum in February, a steady increase up to July, when the maximum is reached, a gradual fall until November, and again an increase in December. In Bengal the maximum is in May, in Lower Burma in April, in Madras and Assam in December, while in the Upper Provinces it is reached as usual in the rainy season.

The following table presents the cholera statistics of the different provinces in a somewhat different way, and shows that besides Assam, Lower Burma, and the Central Provinces, Madras had a lower mortality from cholera in 1887 than the average of the previous five years:—

Province.	Mortality in 1886.	Average mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in rural circles.	Maximum mortality in towns.	Month of maximum prevalence.
Bengal	2·60	2·11	3·40	2·57	10·30	9·55	16·78	May.
Assam	1·75	3·81	2·54	1·74	11·89	3·97	8·05	December.
N.-W. Provinces and Oudh	4·54	1·06	4·04	4·58	17·27	18·56	20·32	June.
Punjab	0·47	0·03	1·47	0·39	2·83	4·60	16·18	August.
Central Provinces	1·43	1·52	2·00	1·37	4·98	8·91	19·08	July.
Berar	5·5	2·8	5·9	5·7	19·20	7·9	27·2	August.
Lower Burma	0·73	1·45	1·49	0·62	4·94	2·42	8·06	April.
Madras	1·0	1·4	1·9	0·9	6·8	3·0	13·6	December.
Bombay	1·56	1·18	0·99	1·64	10·03	6·71	8·63	July.

In Bengal the year was characterised by widespread and very fatal cholera, 172,578 deaths being recorded against 118,368 in 1886. This is equivalent to a ratio of 2·60 per 1,000 of the population, compared with a ratio of 1·78 in 1886, 2·11 in the quinquennium 1882–86, and 1·82 in the decade 1877–86. The wide diffusion of the disease is shown by the fact that 97 per cent. of the registering circles and 10·30 of the villages returned deaths from cholera, compared with 93 per cent. of the circles and 9·33 of the villages in 1886.

The mortality ratios in the several divisions, calculated upon the census population of 1881, and compared with the ratios for 1886, were as follows:—

	1886.	1887.
Burdwan	1·31	0·98
Presidency	—	2·08
Rajshahye	1·75	0·97
Dacca	2·75	2·73
Chittagong	1·04	1·39
Bhagalpur	0·58	1·74
Patna	1·39	4·67
Orissa	4·18	4·87
Chota Nagpur	0·30	2·45

In three divisions, Burdwan, Rajshahye, and Dacca, the ratio was lower than in 1886, while the divisions that suffered most severely were Orissa and Patna. In the Puri district of the Orissa division the death-rate from cholera was 9·75, while in the Gya district of the Patna division and in the suburbs of Calcutta in the Presidency division the death-rate exceeded 8 per 1,000. As regards the seasonal incidence of cholera in the province as a whole, the year began with a heavy mortality in January, the remains of the severe winter outbreak of 1886: this was succeeded by a marked diminution in February and March and the usual rise in April. It remained at maximum rates throughout May, June, July, and into August, when, coincidently with heavy rain, it abated, and continued at a comparatively moderate rate for the rest of the year. The heavy mortality in June, July, and August is the result of epidemic influences in Behar and Orissa, for epidemics usually prevail in these divisions at a later period of the hot weather than they do in Lower Bengal; while, on the other hand, the comparatively low mortality of the later months of the year points to slight incidence of the disease in the lower divisions of the province. The epidemic in Upper Bengal underwent a great and sudden aggravation coincidently with a heavy rainfall at the end of May, which was caused by a cyclonic storm passing up the country from the Bay of Bengal.

The above figures do not include the town of Calcutta, in which there were 1,198 deaths from cholera during the year, and a ratio of 2·76 per 1,000 of population, compared with 1,741 deaths and a ratio of 4·01 per 1,000 in 1886. The disease was unusually prevalent in July and August, and attained a maximum in April.

The mortality from cholera amongst the European seamen in the port was at the rate of 10·03 per 1,000 of average strength, but compares favourably with that of any recent year except 1885.

A small outbreak in the sailing ship "Ardenclutha," shortly after her arrival in the port, requires some notice here, because the Health Officer of Calcutta, in his report for the first quarter of 1887, gives minute particulars of an inquiry he made into the circumstances attending it, and attributes it unequivocally to the use of a certain milk-supply which had been adulterated with the water of a tank into which, he believes, the excreta of a cholera patient had found their way. The Health Officer has evidently made a most painstaking enquiry, and gives a large amount of detail, derived from the cross-examination of ignorant seamen and natives, in which it is impossible to estimate the amount of truth. This outbreak occurred ten days after the ship's arrival in port, and there were five cases of cholera in all, of which one was admitted into hospital on the 9th and four on the 10th of March. The disease was of a severe type, and only one of the patients, the last attacked, recovered. Of the 24 persons in the ship, officers and crew, eight used condensed milk, and of these none were attacked. Of six men who drank no milk one was attacked, and of the remaining ten, who all drank the suspected milk, four were attacked. There were also five cases of diarrhœa amongst the ten milk-drinkers, but two of these turned out eventually to be undoubted cases of enteric fever, and the remaining three were of such a mild nature that they were not sent to hospital. There was also a case of dysentery amongst the men who drank no milk, and a case of diarrhœa among the drinkers of condensed milk. The milkman was only forbidden the ship on the 10th of March, on which day he seems to have supplied milk to the ship, but no cases occurred on the 11th or subsequent days. On these facts the Health Officer founds his opinion that the cholera was the result of drinking this particular milk. It should be noted, however, that the five cases occurred

amongst the men, fourteen in all, who lived in the forecastle, while the remaining ten —and this includes the eight drinkers of condensed milk—were somewhat differently circumstanced, as they lived in the cabin or in deck-houses. The milkman also asserts that he did not take water from the tank which had been contaminated by cholera excreta, but from a neighbouring tank, and the Health Officer is forced to assume either that this statement is untrue or that the fœcal matter found its way in the course of a few days through the soil intervening between the tanks; but the important step of making a careful examination of the water of both tanks with a view to ascertain the presence or absence of cholera dejecta seems to have been entirely overlooked. The whole character of the outbreak is so exactly like that of the usual epidemic in such communities where there is no question of a contaminated milk-supply, that it is impossible to accept as conclusive his opinion of the origin of this particular one on such slender and doubtful data.

In Assam, 1887 was a year of diminished prevalence of cholera, the total deaths recorded from this disease being 7,941, giving a ratio per 1,000 of population of 1·75, compared with a total of 20,188 and a ratio of 4·47 in 1886. This mortality approaches the minimum of 1·71 per 1,000 in 1885. With the exception of the Cachar and Khasi Hill districts, in which there was a slightly increased mortality, the decline was general throughout the province. In the matter of seasonal distribution, the year affords another illustration of the different behaviour of epidemic influences on the Brahmaputra and Surma valleys. In the former the year opened with the remains of a cold-weather outbreak, but this rapidly declined in February and March. From April to June the deaths from cholera were again more numerous, but from July to December there was an almost complete cessation, the deaths recorded in any of the last three months being less than one hundred. In the Surma valley, on the other hand, cholera was in comparative abeyance at the beginning of the year, but increased in April and May. It was checked again by the heavy rains of June flooding the valley, and in July and August the mortality was less than 100 per mensem. It again increased steadily in the last four months of the year until a maximum of 1,235 deaths was reached in December—an ominous token—as the Sanitary Commissioner of the Province remarks, of recurrent epidemic severity in 1888.

The general health of immigrant coolies and their families proceeding by the Dhubri route into Assam was highly satisfactory in 1887. The mortality too from cholera was small, though greater than in 1886, on board the steamers conveying the coolies up the country from Dhubri. A total number of 25,635 emigrants—men, women, and children—travelled by this route, compared with 18,059 in 1886, and the total mortality from all causes amongst them was 18 at Dhubri and 24 on the journey up-country, compared with 33 at Dhubri and 14 on the journey in 1886. There were 20 admissions from cholera at Dhubri, of which 6 were persons who arrived at Dhubri with the disease, 6 were admitted within 24 hours after their arrival, 6 within 48 hours and 2 after 48 hours. In 1886 there were 37 admissions for cholera at the same depôt, of which 12 occurred more than 48 hours after the arrival of the patients at the depôt; and the same number were admitted for cholera in 1885. The following statement, extracted from the annual report on immigration through Dhubri, shows the mortality from the principal classes of disease at all the depôts during the years 1886 and 1887:—

Disease.	1886.	1887.
Dysentery	—	2
Cholera	24	13
Small-pox	—	—
Fevers	4	—
Other diseases	5	5
Total	33	20

Besides these there were 26 cases of cholera on board the mail steamers, of which 16 ended fatally. The Sanitary Commissioner of the Province remarks that,—

"The evidence year after year is strengthened that the cholera which is developed on these river steamers was contracted previously. The severe outbreak which has occurred in 1888 shows the necessity of extending the Assam sanitary rules further

back at least to the depôts in Bengal. It is hard to have the entire odium and loss of life of epidemics charged to Assam immigration, when, in truth, the seeds of the disease were sown elsewhere, and the immigrants arrived already cholera infected."

The total recorded deaths from cholera in the North-Western Provinces and Oudh in 1887 were 200,628, or a ratio per 1,000 of 4·54. The nearest approach to such a mortality in previous years is in 1882, when the total mortality recorded was 89,372 and ratio per 1,000 of population 2·02. That it was also widely distributed is shown by the fact that deaths were recorded in every one of the 49 districts of the province; in 81 per cent. of the registration circles, and in 17 per cent. of the villages. Cholera had prevailed severely during the last three months of 1886, and there were 318 deaths in 15 districts in January 1887. Instead of dying out, the disease increased during the next four months until a maximum of 50,488 deaths was reached in June. In July there were 41,616 recorded deaths; but after this month there was a steady decline until the end of the year, though there were still as many as 1,218 deaths recorded in December. This minimum mortality in January and maximum in June is characteristic of the seasonal prevalence of cholera in these provinces, and the Sanitary Commissioner shows by a comparison of the records of mean temperature at Agra and the records of mortality in the province, in the different months for the last 18 years, that high cholera mortality is coincident with high mean temperature and *vice versâ*. During the first six months of 1887 the mean temperature was greatly higher than the mean of the same six months in the previous 30 years and coincident with this the cholera mortality was abnormally high. He concludes by saying,—"Nothing beyond a general relation between high temperature and high "cholera mortality is claimed, and this relation seems to be clearly established by "the statistics of the entire period for which mortality records of any value exist. "Without placing the abnormally high temperature and the abnormally high rate of "increase of cholera mortality during the first six months of the year in relation of "cause and effect, it is important to show their coincidence."

The general progress of the epidemic was from east to west, both in the plains and the hill districts, the eastern districts suffering most severely before the disease could be said to be epidemic in the western districts; while in the latter the disease reached its maximum intensity later on in the year when the epidemic force had abated in the former. In fact, the western districts seem to afford an exception to the above-mentioned coincidence of high temperature and high mortality, for they suffered most severely during the last six months of the year, which were unusually cool; still it must be noted that the epidemic was never so violent in the western districts as in the eastern.

The districts which suffered most severely, if the records are to be trusted, were the Jhansi and Jalaun districts, in which respectively 17·9 and 15·8 per 1,000 of the population are said to have died of cholera, and it is not encouraging to find the Sanitary Commissioner remarking that—"In no district of these provinces have more steady "and successful efforts been made to secure cleanliness in both towns and villages "than in Jalaun. The concise sanitary reports submitted by Dr. Thomson on the "towns of the Jhansi and Jalaun districts witness to the success of the efforts made "to keep them clean."

The word "clean" can here only be used in a comparative sense, and we must conclude that still greater efforts have yet to be made before even our cleanest towns and villages can hope to ward off or even mitigate the ravages of epidemic cholera.

The Deputy Sanitary Commissioner of the 1st Circle, in Appendix No. 1 of the Sanitary Commissioner's Report, expresses the same feeling when he says he is unable to trace any connexion between insanitary conditions in the villages and high mortality from cholera. This can only be due to the fact that even the cleanest villages are so dirty, for the experience of the cantonments and jails throughout Bengal shows conclusively that the continued enforcement of sanitary rules does lead to at least a comparative immunity from cholera. The following statement, which is extracted from a note from Surgeon-Major Hutcheson, Officiating Statistical Officer (*vide* Appendix B. to this report), gives the ratio of mortality from cholera per 1,000 of average strength in cantonments and jails for the two 15-year periods 1858 to 1872 and 1873 to 1887. The striking diminution in the second period is the total result of diminished cholera prevalence in each of the cantonments and jails with extremely

few exceptions, and it is a certain index of the good results which follow the persistent application of general sanitation to communities under the guidance of experienced medical officers:—

	15 years, 1858 to 1872.	15 years, 1873 to 1887.
Average mortality from cholera per 1,000 of average strength among European troops, Bengal Army.	8·27	3·01
Ditto among Native troops, Bengal Army -	2·57	1·34
Ditto in jails, Bengal Presidency - - -	7·94	3·27

In the Punjab the total deaths attributed to cholera in 1887 were 8,804, compared with only 12 in 1886, 1,936 in 1885, 26,135 in 1879, and 43,146 in 1867; the ratio per 1,000 of the population in 1887 being 0·47. It may, therefore, be described as a moderately epidemic year, but the disease was widely distributed, deaths from cholera being recorded in each of the six divisions and in 25 of the 31 districts. The greatest mortality occurred in the Karnal district, which is in the eastern portion of the province; the Lahore district, which is central; and in the north-western corner of the province, comprising the Bannu, Kohat, Peshawar, and the southern portion of the Hazara districts. The following districts only had an entire immunity from the disease, viz., Simla, Hoshiarpur, Shahpur, Dera Ismail Khan, Dera Ghazi Khan, and Muzaffargarh. No cases were recorded in the first three months of the year. There were a few sporadic cases in April and May, but the disease did not attain to an epidemic until June. It commenced in the eastern districts, but within eight days had appeared in the Lahore district, and in another fortnight was prevalent in the city of Peshawar. Of the total deaths 3,446 occurred in August and 3,136 in September, after which the disease rapidly subsided, and had almost ceased by the end of the year, though it was still present in December in the Bannu and Jhelum districts.

In the Central Provinces during the year 12,576 deaths were recorded from cholera, giving a ratio of 1·43 per 1,000 of the population. This is less than in 1886, when there were 16,679 deaths, or a ratio of 1·89, or in 1885, when there were 21,868 deaths and a ratio of 2·48. The disease prevailed in 17 of the 20 registration districts, but in 10 of these the deaths were less than one per thousand of the population. It was, therefore, widespread, and while comparatively mild in many districts, very severe in others, the death-rate in the Sambalpur district being 9·27 per 1,000 and in Narsinghpur 7·27. The cholera death-rate in the towns was 2·00 per 1,000, and 11 out of 18 headquarter towns were affected, while the rate for rural tracts was 1·37. The death-rate in the towns of Sambalpur and Narsinghpur was respectively 18 and 19 per 1,000. In the Wardha district 26 per cent. of the villages were attacked, in the Narsinghpur district 25 per cent., and in Sambalpur district 18 per cent. Deaths were reported in all months of the year, but there were very few until May; there was a marked increase in June; a maximum of 3,087 in July; in September the disease had begun to abate in most districts, and in October there was a fall in the number of deaths recorded in almost all districts. In the last month of the year the disease had almost ceased.

In Berar the total number of deaths registered from cholera in 1887 was 14,326, or 5·5 per 1,000 of the population, compared with 976 deaths and a ratio of 0·4 in the previous year. The disease was generally distributed throughout the province, the Amraoti and Buldana districts suffering most, the Ellichpur district least. A preliminary small outbreak occurred in the Buldana district in April, but had apparently ceased before the general epidemic in all districts began in June. The Sanitary Commissioner says that though the disease was generally attributed to importation, careful inquiry by the civil surgeons showed that there was no evidence of this, and he believes the outbreaks to have been everywhere of indigenous origin. He remarks that—"The history of cholera in 1887 was marked by one of those epidemic "outbreaks which steadily recur in Berar at varied intervals. These visitations, "as remarked in previous reports, come and go in a remarkably constant rotation, "and show a tendency to triennial periods, each epidemic revival being attendant "on an abundant rainfall above the average;" and he gives a table designed to show this coincidence and the triennial recurrence of epidemics for the last 13 years in

the province. This question was previously discussed in this report for 1885, and it can only be repeated that the number of years for which data are given is not sufficient to allow of safe generalisation; but, so far as the figures go, they seem to indicate that years of great rainfall are usually years of high cholera mortality, but that years of average or low rainfall may or may not be years of comparatively great incidence of cholera. The triennial recurrence is even less apparent, the years of greatest prevalence being 1875, 1878, 1883, and 1887.

The deaths recorded from cholera in Bombay amounted to a total of 25,711, or a ratio of 1·56 per 1,000 of population, compared with only 167 and a ratio of ·01 in the previous year. The mean mortality of the ten years 1887 to 1886 equalled a total of 22,543 and a ratio per 1,000 of 1·38, so that the year 1887 is slightly above the average in the matter of cholera. The disease was entirely absent in January, made its appearance in February, increased markedly in May, and reached its greatest intensity in July. It began to subside in August, and had abated considerably by the end of the year, 632 deaths being recorded in December. The disease was widespread and affected in some degree every Collectorate; but it was most severe in the Deccan, and especially in the three Collectorates of Satara, Sholapur, and Ahmednagar, while it was very mild in Sind. Of the 24,535 villages in the whole Presidency 10·03 per cent. recorded deaths. In the Sholapur Collectorate 39·77 per cent. of the villages returned deaths, and in the Satara Collectorate 32·91.

The Sanitary Commissioner points out that the above-mentioned seasonal incidence is characteristic of the disease in this Presidency, the month of least intensity being generally December or January, a marked development occurring in April or May, followed by a rapid increase in May or June, and maximum in July, while the abatement commences in August. The prevalence of cholera in Bombay is coincident with the rise of temperature and moisture in the atmosphere. He gives a table which shows that there has been a remarkable cycle of minimum intensity every sixth year, the years 1867 and 1868, 1874, 1880 and 1886 being distinguished by a minimum number of deaths from cholera in the whole Presidency, while the same years show a similar minimum even more remarkably in the city of Bombay. Comparing the aggregate deaths in the three periods 1866 to 1872, 1873 to 1879, and 1880 to 1886, it is shown that while the deaths in the third period are less than those in the second, they exceed considerably the deaths in the first, and, as the second period includes the exceptional famine years, it is argued, apparently with justice, that no improvement has followed the measures which up to this time have been adopted to arrest the ravages of the disease. That cholera is to a certain extent preventible by ordinary measures of sanitation is, however, shown by the history of the disease in the city of Bombay, where during the nine years ending with 1865, in which year the municipality was instituted, there were 19,996 deaths from cholera, while in the 21 years ending with 1886 there were only 10,509 deaths from the same disease. The deaths from cholera in Bombay City in 1887 amounted to 262, giving a ratio per 1,000 of population of ·34.

The total number of deaths from cholera recorded during the year in the Madras Presidency was 28,359, giving a ratio per 1,000 of population of 1·01. This is much greater than in the preceding year, when the total was 12,417 and the ratio 0·4, though less than in 1885, 1884, and 1883, in which years the ratio was respectively 2·0, 2·7, and 1·2. The mortality of 1887 from this cause has been exceeded in eight of the preceding 19 years. In the first three months of the year the disease was almost confined to the districts on the eastern coasts, Godavari and Kistna especially; but in April and May it appeared in the central districts, and gradually spread all over the Presidency until every district was affected more or less. In December every district except one returned deaths from cholera, and the total of the deaths in this month, 13,626, is more than six times the mortality in any other month of the year. This heavy mortality in December is largely accounted for by the severity of the disease in the southern districts, many of which were only reached late in the year, and especially in Trichinopoly and Tanjore. The district which suffered most severely was one of the southern districts, Trichinopoly, with a ratio per 1,000 of population equal to 3·6. A central district, Cuddapah, follows next with a ratio of 2·9 per 1,000; and an eastern district, Godavari, stands third with a ratio of 2·0.

In the town of Madras there were 471 deaths from cholera, or a death-rate of 1·2 per 1,000. No explanation can be offered for the renewed prevalence of the disease in this Presidency during the year under review.

In Lower Burma there were 2,649 deaths from cholera recorded during the year, or a ratio per 1,000 of ·73, which is about half the ratio of the previous quinquennium. Sixty-six per cent. of the deaths were returned in the Akyab and Amherst districts, while the districts least affected were Mergui, Tavoy, Toungoo, and Thayetmyo. The greatest mortality occurred in March, April, and May, while the smallest was in the monsoon months of June, July, and August.

The following is a brief review of the circumstances attending outbreaks among troops and prisoners, as reported by the different medical officers, set forth under the same headings as in former years.

Among European troops, as is usual, a considerable number of the patients who were first attacked in any outbreak are said to have committed some indiscretion in diet or to have been exposed to chill or fatigue. Thus at Chaubuttia the first case had been drinking beer freely, and on the previous day had got a severe wetting, but did not change his clothes. At Poona the first man attacked had been absent for three days and returned wet and drunk on the morning of the day he was taken ill. At Fyzabad the first patient, a debilitated alcoholist, had chilled himself by remaining in a cold bath for an hour just before the attack commenced. At Sipri, the first patient, a champion athlete, had been out in the morning practising for a half-mile race, returned to barrack over-heated, and dosed himself with draughts of water and two seidlitz powders, and was taken ill with cholera a few hours afterwards. There are a large number of cases, however, in which no such antecedent indiscretion or exposure can be assigned.

Among native troops, when any predisposing cause is suggested, it is usually excessive fatigue or some excess or irregularity in diet. Thus the first patient at Benares had been eating dâl to excess just before the attack; the first at Kirkee had been gorging himself with goat's flesh during the previous night; the first at Sirur was a debilitated, anæmic, dyspeptic man who had been feasting to excess on sweetmeats; the first case at Karachi was in a sepoy who had just come off a long journey by rail, during which he had lived on parched gram; in two instances at Edwardesabad the first patient had just arrived by road from Kohat; at Sehore the first patient was on his way back from Bhopal; and there are several other instances of men being attacked just after their return to their stations by a fatiguing journey.

Among prisoners in jails who are under much more direct observation than soldiers, in a very large proportion of the outbreaks the first patient is stated to have been exposed to no unusual condition just before the attack. In a few instances fatigue is mentioned, as at Midnapore, where the first case had arrived that morning from Cuttack, a 12 days' march, at an average rate of 15 miles a day; or at Bhagalpur, where the first attacked was a hospital sweeper who had been overworked for some time on account of the prevalence of diarrhœa and dysentery. With regard to all the predisposing causes it may be said that they are the ordinary adverse conditions to which individuals of the different classes mentioned are constantly exposed, or deliberately expose themselves, generally with impunity; and if they are in any way the causes of cholera they must be so in a very minor degree.

Among European troops it is stated in 23 outbreaks that there was no prevalent diarrhœa either before or during the continuance of the cholera. In eight outbreaks there were a few cases of diarrhœa at the same time, and in 10 it was distinctly prevalent. Among Native troops there was no diarrhœa before or during the cholera outbreaks in 24 instances; a few cases only in 18, while it was distinctly prevalent in 11. In jails there was no diarrhœa in 13 outbreaks of cholera; a few cases, but nothing unusual, in 18; and distinct prevalence in 11. The difficulty in drawing a line between what is usual and what is unusual in the matter of prevalence of diarrhœa, especially in jails; the natural tendency to return all cases of diarrhœa during a cholera outbreak as cholera; and, on the other hand, the increased attention which is paid at such times to cases of mild diarrhœa, makes it impossible to draw any conclusion from such figures.

Among European troops, in 29 outbreaks, for which the necessary data are reported, men were attacked in 107 buildings out of 457 occupied. At Peshawar 23 attacks occurred in 10 out of 15 buildings. At Neemuch, where there were also 23 attacks, these occurred in 5 out of 11 buildings. Among Native troops the necessary data are given in 39 instances, and in these, out of a total of 3,419 buildings occupied, 118 furnished cases. In the two battalions of Gurkhas at Dehra Dun there were 76 attacks furnished by 39 buildings out of 258 occupied. In 38 outbreaks among

jail prisoners, 118 buildings, out of 914 occupied, furnished cases. The fact that the occurrence of a case of cholera in a building generally leads to its immediate evacuation must have a considerable influence upon the figures under this heading.

Excessive and continued rainfall and oppressive muggy weather are frequently noted. At some stations, on the contrary, at Peshawar, Kohat, Naini Tal, and Banda, for instance, the air is said to have been unusually dry. At some stations the first case is said to have followed a severe thunderstorm, while at others the outbreak commenced during a break in the rains.

Except in the following instances, it is said in the reports that there was no connexion traceable to any previous case, or it is mentioned in a general way that the first patient has recently visited some place, city, bazaar, or elsewhere, in which cholera was prevalent. At Rungpore, it is stated that the first two cases had been in close communication with a cartman who had been attacked with cholera near the main gate of the jail. The first case at Midnapore had four days previously been in attendance on another prisoner who was taken ill and died on the road between Cuttack and Midnapur. An indirect communication is mentioned at Lucknow, where, two days before the outbreak of cholera in the female ward of the jail, there is said to have been a fatal case of cholera in the family of the female warder who lived outside the jail in a neighbouring village.

Among European troops in 41 communities, for which the particulars are given, there were 611 attendants upon 192 cases of cholera, and of these 3 were attacked with the disease. In addition to the above there were two communities in which the number of attendants is not given; but in the case of both we are told that none of the attendants were attacked. A few particulars are here given of each of the instances in which an attendant suffered:—

(1.) At Benares there were were 7 attendants, of whom 1, an orderly of the Army Hospital Native corps, was attacked. It may be noted that another man of the same corps who had not been in contact with the cholera patients, was taken ill on the same day.

(2.) In the standing camp at Ranikhet there were 33 attendants, of whom 1, a soldier who had volunteered to nurse his comrades, was attacked.

(3.) At Allahabad there were 36 attendants upon cholera cases, of whom 1, the wife of a serjeant-major, who had nursed her child through an attack of cholera, was taken ill afterwards herself.

In these three outbreaks there were 3 individuals attacked, out of a total number of 76 attendants upon 24 cases of cholera. Excluding these, there 38 other outbreaks in which 535 attendants waited upon 168 cases of cholera with impunity.

Turning now to Native troops, we have particulars given for 49 communities in which there were 245 cases of cholera in all. Upon these there were 1,111 attendants of whom 8 were attacked with the disease. There are four communities for which the number of attendants is not given, but in all these it is mentioned that none of the attendants suffered. Of the eight instances of attendants being attacked 7 occurred in the Gurkha regiments at Dehra Dun, where there were 297 attendants upon 76 cases of cholera. In this connexion the medical officer of the 2nd battalion 2nd Ghurkas remarks that—"It is curious to note that the sepoys who did not act as "sick attendants were struck down in the proportion of more than three to one "compared with their companions who aided in nursing the sick. Thus out of 204 "orderly sick attendants 3 were attacked, or 1·47 per cent., while out of the remaining "600 sepoys, 33 were attacked, or 5·55 per cent. The sick attendants were not "selected men, and the only precautions to which they were subjected were the "cooking and eating of all food in a building apart from the sick, washing before "meals, and, amongst a certain number at the commencement of the outbreak, acid "drinks."

Of the four attendants attacked in the 1st battalion of the 2nd Gurkhas, one was a sepoy who had ceased to attend on the sick for a week before he was himself taken ill, and two were mule-drivers who had ceased attendance four days previously. At Kohat an old man attended on his son and was taken ill himself the next day.

In 38 jail communities there were 596 attendants upon 295 cases of cholera, and of these 28 were themselves attacked. The most remarkable instance was at Lahore, where, of 54 attendants, as many as 21 were attacked. Of these 1 was a jemadar, 1 a munshi, 3 were sweepers, out of 9 of this class employed about the sick; and 16 ordinary prisoner-attendants. The medical officer states that throughout the

epidemic more attacks took place proportionately in the hospital than in the rest of the jail, and this, notwithstanding the early evacuation of the hospital buildings. At Lucknow a prisoner compounder and 2 hospital sweepers were attacked.

Communities.	Number of cases of Cholera treated.	Medical Officers, Hospital Assistants, and other Attendants on Cholera Cases.		Percentage of Attendants attacked.
		Number.	Number of these attacked.	
European Troops	192	611	3	0·5
Native Troops	245	1,111	8	0·7
Jails	295	596	28	4·7
Total	732	2,318	39	1·7

Among European troops sanitary defects are noted in connexion with 10 out of 43 outbreaks. At Dum-Dum, we are told, the water has been reported by the medical officer and the Chemical Examiner as unfit for use. Only one case of cholera, however, occurred at this station. The water-supply is also complained of at Quetta and Chauburtia. The barracks are said to be defective at Dinapore; as also are the married quarters, in which the cholera occurred, at Allahabad Fort. At Naini Tal and Nowgong the surface drains are reported to be imperfect; while at Meean Meer the "trench system" is said to have been imperfectly carried out, and not in accordance with regulations; the tanks for washing clothing were unsatisfactory, and the milk supply was of inferior quality. Among Native troops sanitary defects are mentioned in connexion with 15 out of 52 outbreaks. At Kohat a large stream is complained of by more than one medical officer, as running first through the bazaar, where it is defiled in every possible way, and afterwards close to the Lines. The proximity of irrigation canals to the Lines, and the consequent facilities for drinking impure water are mentioned both at Edwardesabad and Meean Meer. At Barrackpore and Sirdarpore we are told that the men drank impure river water. At many stations the Lines are said to be overcrowded, or water-logged, or to have defective conservancy arrangements. At Bombay the medical officer of the 21st Bombay Infantry, says:—

"There are no latrines in the Lines, consequently the pit intended to receive ablution water is used for natural purposes."

Among jails, sanitary defects are noted in 9 out of 43 outbreaks. At Moulmein the site of the jail is said to be bad, as it is built in a hollow, half encircled by a hill, with a very insanitary quarter of the town on one side and cemeteries on the other; while the water-supply is liable to contamination by subsoil percolation. The water-supply is also complained of by the medical officers of the Lahore, Banda, Agra, and Ajmere jails.

The effect of moving the affected body of men into camp seems to have been, in almost all cases in which it was undertaken, strikingly beneficial. In the great majority of instances no further cases occurred after the first move, and in only a very small number did more than one case occur. In the less favourable instances the medical officer often expresses the opinion that the effect was more beneficial than would be inferred from the figures, and in all cases the general health of the moving parties is reported to have been good. The European troops at Neemuch, among whom there were 23 cases in all, were sent into camp in four parties, and in 2 of these no further cases occurred after the first move; but the third party had 7 attacks at its first camp, and the fourth party was moved three times and had 8 attacks in camp. In the 2nd battalion Wiltshire Regiment at Peshawar, in which there were also 23 cases, the men were divided into three parties, in two of which a single case occurred after the first move, but none after subsequent moves; while the third party was free from the disease directly it left the station. In the 2nd battalion 2nd Gurkhas at Dehra Dun, in which there were 36 cases of cholera in all, there were four parties of men sent into camp. In one party there was 1 fresh case after the first move, 1 after the second, 2 after the third, and no more after the fourth; while the other three parties each had a single fresh case after the first two moves, but none after the third. In the 3rd Light Cavalry at Neemuch, in which there were 18 cases of cholera,

four parties went into camp, and three of these each had a single case after the move, but the fourth remained free from the disease. In 13 outbreaks in jails the prisoners were moved into camp, and in 9 of these instances no further cases occurred after the movement. In one party from the Moulmein Jail 11 cases occurred at the first camp, but after a second move there were no fresh cases. At the Lahore Jail the prisoners were camped out in two parties. At the first camp there were 3 fresh cases in one party and 30 in the other; after a second move there were 12 cases in the two camps together, but after a third move the epidemic ceased. Even here the medical officer remarks :—

"The effect of removal was beneficial, I think, in any case on the general body of prisoners, and the feeling of relief and the diminution of cases among the prisoners as each move was accomplished was very manifest."

A remarkable outbreak of what the medical officer calls "epidemic diarrhœa" occurred in the 30th Punjab Infantry while the regiment was on the march from Peshawar to Mooltan in December 1887. The regiment had been in bad health previously, while quartered at Peshawar, the sepoys, more especially the younger ones, suffering from repeated attacks of ague. In consequence of this many of the men were in a debilitated state when they commenced the march, but it was hoped that the change of scene, air, and occupation would benefit them. The regiment left Peshawar on the 5th of December, and reached Kohat in three marches on the 7th without any unusual sickness occurring. After a halt on the 8th the regiment proceeded on the 9th from Kohat to Lachi, and it was during this march that the outbreak commenced under the circumstances, and in the manner described as follows by the medical officer in his diary :—

"*December 9th, Kohat to Lachi.*—Water on the road bad. Lots of stagnant brackish pools from which the men were ordered not to drink, but disobeyed. Left Kohat at 6 and arrived at Lachi at 1 p.m. Camped near village. Water pretty good from a spring near the village. Just before reaching camp the first case of diarrhœa occurred. A sepoy complained of diarrhœa and pain in his belly, with great prostration. He had been in good health previously. He said he had drunk salt water on the way. He was given a dose of chlorodyne and brandy and put in a dandy. On arrival at camp his body was warm, his temperature normal, but his pulse very weak. He had two greenish stools and got a lead and opium pill. He had no more motions after that, but his pulse got imperceptible, and he sank into a state of extreme collapse, in which he died at 11 p.m. Stimulation by brandy, ether, mustard plasters, frictions, heated stones applied to the body, &c. was tried without avail. He passed urine freely."

A second case was admitted at 3 p.m. of the same day with diarrhœa, but no vomiting, and died in collapse at 11·30 p.m. On December 10th the regiment continued its march and reached Banda; but before leaving Lachi two more cases of the peculiar diarrhœa had occurred, and one of these died on reaching camp. The water on the road was again brackish. On the same day, after reaching Banda, there were five more admissions and another death. On December 11th, the camp was only shifted about a quarter of a mile, and there were 11 admissions and two deaths from diarrhœa and about 60 admissions from ague. On the 12th the regiment quitted Banda and reached Tubakki. The water was again bad, and the men, weakened and dispirited, fell out in large numbers. There were on this day six admissions for severe and 10 for slight diarrhœa, and two deaths. On the 13th a halt was made, and there were three admissions for severe and 12 for slight diarrhœa, and two deaths. The medical officer, however, notes on this day that the disease is getting much less virulent and more easily stopped. On the 14th and 15th the regiment remained at Tubakki, and there were five admissions for diarrhœa and one death : ague, however, continued very prevalent. On the 16th, 17th, and 18th, the march was continued to Bannu. These three marches were very exhausting : the water continued to be brackish, fever was as prevalent as before; still there were only a few cases of diarrhœa, and these of a mild character, and it was evident that the outbreak had ceased.

The outbreak therefore lasted seven days, from the 9th to the 15th of December, and there were 41 admissions, not including about 50 cases of slight diarrhœa, and 10 deaths. Of the first six admissions four died, but afterwards the violence of the disease seemed to diminish. Of the 10 deaths six appear to have occurred in less than 24 hours after attack, three in less than 48 hours, the last fatal case only living more than 48 hours. All the men attacked were recruits or young sepoys, and of the 10

who died, five had been in good health previously. As regards etiology the medical officer says :—

"No cause can be assigned for the outbreak except the bad water in the district passed through, there being much salt rock all the way, coupled with the reduced state of the men. The first night the regiment was camped at Banda there was a bitterly cold wind blowing, which may have had some effect."

And in support of his diagnosis of epidemic diarrhœa and not cholera, he says :—

"The onset and course of the disease was very uniform. It began with liquid greenish stools passed two or three times, accompanied with griping pain. Then prostration and collapse with thirst in some cases, and in all furred tongue and loss of appetite. The face got shrunken and the eyes sunk, but urine was passed freely, there was little vomiting, and the body and breath never got cold as in cholera. The stools always remained greenish, sometimes watery with mucus, sometimes feculent."

The general character of the outbreak is, however, exactly that of cholera when it attacks a moving regiment, and it must be noted that cholera had been prevalent during the year in all the districts through which the regiment was marching. There had been cholera amongst the troops in these districts in July and August, and amongst the civil population, in the Peshawar District up to the 24th of November, in the Kohat District up to the 30th of October, in the Bannu District up to the 9th of December.

mall-pox. Taking India as a whole, small-pox was rather more prevalent in 1887 than in 1886, the recorded deaths numbering 65.755 in place of 51,097. This increase was shared by all provinces except Bengal and the North-Western Provinces.

The low ratio in the North-Western Provinces (0·19) is the more remarkable as the early months of the year were exceptionally hot and dry, conditions which generally obtain when small-pox is rife. The high ratios in Mysore (1·61) and Coorg (0·74) still continue, and it is satisfactory to learn that it is in contemplation to introduce compulsory vaccination into the former province.

evers. The total number of deaths from fever recorded during the year throughout India was 3,581,623, compared with 3,470,754 in 1886, and 3,396,239 in 1885. Except in the Punjab, there is no very remarkable difference in the death-rate from fevers in the two years. A slight increase is to be expected in all provinces as the result of improved registration.

There has been again an advance in the total recorded mortality from fevers in Bengal, so that the figure (16·44 per 1,000) is higher than in any year in the decade; but this is probably the result of advancing registration rather than of any real increase in the prevalence of fevers. The disease is said to have prevailed with greatest virulence in 36 registration circles, while this could be said of only 24 circles in 1886; so if this may be taken as a test it was more prevalent than in 1886, or any of the four immediately preceding years, but less than in the epidemic years 1880 to 1882, in which, respectively, 124, 218, and 58 registration circles were attacked with excessive violence. The ratio per 1,000 in urban circles was 10·45, in rural circles 16·66, from which it would appear that fever is diminishing in urban and increasing in rural populations: but this again is probably only apparent and due to diminished attention to registration in towns under municipal government. The recorded deaths under this head in the province exceeded 100,000 in each of the months January, October, November, and December; while the smallest monthly total was recorded in June, viz., 69,851. Of the eight districts in which the death-rate from fevers is highest, seven are situated in Northern Bengal, and the Sanitary Commissioner believes that this indication of greater prevalence in the northern parts of the province represents a fact, and says :—

"When events come to be truly recorded, I think it will be found that the districts comprised in the great triangle lying between the Gunduck and the Ganges on the south, the Brahmaputra on the east, and the Himalayas on the north, will be the area specially afflicted by severe malarious fever."

The importance of fever as a cause of mortality in the North-Western Provinces is well shown this year, in which, although the cholera mortality was more than double that of any previous year, out of a total mortality from all causes of 35·86 per 1,000 of population, 25·76 is attributed to fevers. And it must be rememberd that besides the large number (1,136,496) of persons who died of fever, there was no doubt a still larger number reduced to a hopeless condition of ill-health, and consequent poverty

and misery, by the same cause. The recorded deaths in 1887 are fewer than in 1886 by 80,122, a reduction which is partly accounted for by the large mortality from cholera, but which was, with a few exceptions, general throughout all the divisions of the provinces, the only division which showed any marked increase being Jhansi. The Sanitary Commissioner shows that—"Of the 12 districts with the highest fever "mortality, 8 belong to the list of 13 which are canal-irrigated; of the 12 districts "of lowest fever mortality not one is canal-irrigated. Of the 20 towns of highest "fever mortality, 19 belong to the list of 40 which lie in canal-irrigated districts; "of the 20 towns of lowest fever mortality only one belongs to a canal-irrigated "district. Similar statistics are repeated from year to year, and may be left to tell "their own tale."

The statistics of 1887 are also said to show once more that, although the prevalence of fever in the province, as a whole, does not necessarily vary with the rainfall, and although the districts with the greatest rainfall are not the districts of highest fever mortality, the annual mortality from fever in any particular district varies, as a rule, directly as the rainfall. The conclusion drawn by the Sanitary Commissioner is as follows:—"All these statistics point in the same direction—to the intimate "relation between malarial fever and excess of moisture in the soil. As the cause of "fever is the same in these provinces as elsewhere, so likewise is the remedy. "Removal of the excess of moisture in the soil by efficient drainage will diminish if "it will not entirely prevent it. All other remedies are of comparatively little avail."

With such conclusions regarding the causes of fever in these provinces before us, it is satisfactory to know that some effort is being made to improve the drainage of some of the most water-logged parts of the country. During the year an important drainage project, called the "Karwan Nadi Improvement," was in progress, by which the drainage of portions of the Bulandshahr, Aligarh, Muttra, and Agra districts will be greatly improved. A natural water-channel has been improved for a distance of 54 miles to a point where it empties itself into a ravine with an excellent slope down to the River Jumna. Another project of a similar kind, know as the "Somna drainage "cut," was about to be commenced.

In the Punjab the deaths recorded from fevers numbered 447,994 during the year, or a death-rate of 23·78 per 1,000 of population. This is higher than the recorded fever mortality in any of the previous six years except 1884. The Sanitary Commissioner believes that a principal cause of the increased mortality from these diseases during the year was the heavy rainfall that occurred during the months of August and September; but he points out that there must have been other factors at work, for in the districts most severely visited an increased mortality from fever had already begun in the period March to July, in which the rainfall of 1887 was considerably below that of 1886. Fevers were most severe in the districts of Gurgaon, Delhi, Karnal, and Rohtak, the same districts which with Umballa headed the list in the previous year. The death-rate from fevers in these four districts ranged from 35·55 per 1,000 to 48·34. In six other districts it exceeded 25 per 1,000. Excluding the hill and frontier districts, which are exceptionally circumstanced, the districts which showed the lowest mortality from fever were Jhang, Montgomery, and Shahpur,—all districts in which there is a low rainfall and comparatively little inundation from canals and rivers.

In the Bombay Presidency 308,722 deaths were reported from fevers against 281,450 in 1886, the mean total for the previous 10 years being 288,280. An increased mortality, compared with the previous year, was recorded in every registration district except Sind, and in every month of the year except January. The highest monthly mortality is recorded in the last five months of the year as usual; the maximum being in November with 29,042 deaths; the minimum in February with 22,144.

In the Madras Presidency the recorded deaths from fever (240,860 or 8·6 per 1,000) were more numerous by 19,181 than in the previous year; a higher mortality from these diseases being recorded in all but seven of the 22 districts. Amongst municipal towns 28 recorded a higher death-rate from fever than in 1886, 24 a lower rate, and 2 the same. The town of Berhampore is conspicuous with a death-rate of 43·2, compared with a district ratio of 18·6; but in only 14 of the municipal towns was the death-rate from fever higher than in the district in which they are situated—a fact which, if the figures are at all reliable, points to the need of improvement in village sanitation. The death-rate from fever in all municipalities together was 6·3 per 1,000, while that for villages was 8·8.

In Berar the total number of deaths registered from fevers during 1887 was 48,114, or in the proportion of 18·3 per 1,000 of the population, against a total of 45,643 in 1886, and a ratio of 17·3 per 1,000. A more than average mortality was recorded in every district; but Wun, as usual, shows the highest ratio, 25·7, and Basim the lowest, 11·3. The highest mortality occurred in August and September; the lowest in May and June. The Sanitary Commissioner believes the cause of the increased mortality to lie in an increased rainfall more evenly distributed, together with the epidemic tendency of the year; while as regards the diseases which are included in the term "fevers," he states that the fevers of the plains are, as a rule, simple ague complicated in severe cases with pneumonia, but in the hilly tracts a more severe form of fever, of a bilious and remittent type, prevails. Of the simple form in the plains, the immediate causes are chiefly chills and insufficient clothing.

There was a slight diminution in the death-rate from fevers in the Central Provinces as a whole in 1887, 19·20 per 1,000 of population against 20·01; but the death-rate of the previous year was exceeded in 12 of the 20 registration districts. The Sanitary Commissioner believes that, as registration becomes more correct, the recorded mortality from fevers will be comparatively lower, while that from bowel complaints will increase.

In Assam the mortality from fevers was greater than in the previous year, the ratio rising from 14·10 to 14·38 per 1,000. Deaths under this head were reported from 521 out of 629 registration circles, and from 11,409 villages out of 16,074. The total recorded deaths amounted to 65,105. The smallest monthly totals were recorded in January, February, and March; the largest in December, July, and November. The death-rate from fevers in the Goalpara district, which heads the list, was 34·73 per 1,000.

In Lower Burma there were 31,825 deaths recorded from fever, or a ratio per 1,000 of population of 8·71, compared with a quinquennial ratio of 7·95. The seasonal history of fevers is the opposite of that of cholera, March, April, and May being comparatively healthy; while July, August, and September are the worst months. In short, high fever mortality in this province mostly coincides with heavy rainfall and rise of subsoil water.

Bowel complants.

The deaths recorded from bowel complaints numbered 290,548, compared with 264,499 in 1886. This figure is nearly equal to the total deaths from this cause in 1885, 293,638, and is greater than in 1884 and 1883. The only remarkable variation is in Berar, where there were 21,530 deaths and a ratio of 8·2 per 1,000, compared with 16,791 deaths and a ratio of 6·4 in the previous year. It is probable, however, that even the higher figure is below the truth; the registration of disease being still very imperfect in some of the districts.

Injuries.

Injuries have decreased in the year under review, the total deaths recorded in the whole of India under this head being 82,208, compared with 87,469 in 1886. As regards the different classes of injuries, suicides have increased from 9,251 in 1886 to 9,308 in 1887. This increase in suicides occurs in the three Provinces, Bengal, North-Western Provinces, and Madras, in which the decrease in injuries generally is most marked. Deaths caused by snakes and wild beasts decreased from 25,602 in 1886 to 23,420 in 1887. Deaths from wounds and accidents show a decrease from 52,616 in 1886 to 49,480 in 1887.

All other causes.

After deducting all the deaths occasioned by the foregoing causes, there remains a total of 1,002,863 due to all other causes.

Vaccination.

The progress of vaccination in India as a whole is satisfactory. The staff of the Vaccination Department has been increased in some degree in five provinces, and, compared with 1886, the total number of persons vaccinated, and the average number of operations performed by each vaccinator, has increased in every province from which statements have been received. Except in Berar the ratio of successful vaccinations per 1,000 of the population has increased, and the percentage of annual estimated births successfully vaccinated is also greater in all provinces except Assam. The average cost of each successful case is less in 1887 than in 1886 in seven provinces, and varies from Rs. 0-1-6 in Bengal to Rs. 0-7-2 in Lower Burma.

During 1887–88 the principal changes introduced in the constitution of the Vaccine Department in Bengal were the substitution of the paid establishment by licensed vaccinators in the Ranchi and Sonthal Pergunnahs circles, the increase in the number of deputy superintendents from 11 to 12, and the increase in the number of vaccinators by 55. The sphere of the working of the department was also extended over a population numbering 2,542,131 in excess of the population embraced in 1886–87. The total number of operations performed by the licensed and paid agency combined amounted to 1,639,694, or an average of 762, by each operator, against 1,522,176 and 726 respectively in the preceding year. Of these 1,620,672 were successful in primary cases and 1,454 in re-vaccinations, or at the rates of 99·33 and 37·38 per cent. On the whole, 30·41 per 1,000 of population were protected during the year by the Vaccine Department against 29·68 in 1886–87. In addition to the above 78,961 operations were performed by the vaccinators attached to the municipalities, dispensaries, &c. Compared with the previous year this shows a falling off of 9,140 operations, the result, probably, of a reduction in the number of this class of vaccinators from 248 to 223. In these cases the success attained in primary operations was 94·53 per cent., and in re-vaccinations 61·80 per cent. of the operations. It will thus be seen that in all 1,718,655 operations were performed in the entire province, and of these 1,695,348 cases were successful. The total number of children protected in the first year of their birth numbered 239,796. The total cost of the department was somewhat greater than that of the preceding year, but the average cost of each successful operation diminished from Rs. 0-1-7 to Rs. 0-1-6. Bovine lymph was largely used for carrying on vaccination, and is stated to have been successful. The Compulsory Vaccination Act was extended to 40 towns during the year, and has been worked with more or less efficiency. The Act forbidding inoculation was extended to seven thanas in Backergunge and six thanas in Gya.

During 1887–88 there was an average increase of only four vaccinators on the special staff of the North-Western Provinces; but the total number of operations and the number operated on by each vaccinator rose respectively to 751,875 and 1,134 from 713,916 and 1,083 in 1886–87. Among these the proportion of success in primary cases was also somewhat higher, the percentage being 93·40 against 92·80 in the preceding year; but in re-vaccinations the ratio of success was even lower than the already low ratio of the previous year, viz., 27·25 per cent. against 28·08. In all 14·93 per 1,000 of the population were protected by vaccination, and of these about 7 per 1,000 were children in the first year. The total cost of the department increased from Rs. 1,21,137 to Rs. 1,33,011, so that, notwithstanding a large increase in the total number of operations during the year, the cost of each successful case rose from Rs. 0-3-1 to Rs. 0-3-2.

During 1887–88 the strength of the Punjab vaccination establishment remained almost the same as in the preceding year; but the total number of operations performed throughout the province, including cantonments, increased from 627,313 to 680,742, and the average number of persons operated on by each vaccinator from 2,172 to 2,347. Of the above total 586,117 operations were performed by the district staff, 80,409 by the special staff, 7,764 by cantonment vaccinators, and 6,452 by the medical subordinates attached to dispensaries. Out of these, 621,858 operations in all proved successful, or at the rate of 95·2 per cent. in primary cases and at 47·4 in re-vaccinations; and about 32·36 per 1,000 of the population of the province were protected by this means. The number of children under one year of age successfully vaccinated during the year was 447,688. These statistics show that the results of the year under review were much more favourable than those of the previous year, although both the total expenditure incurred for the maintenance of the department and the average cost for each successful case were less. Arrangements were made for carrying on operations with animal lymph in 14 districts; but it was only in three of these that the plan was carried out on an extensive scale. Vaccination with buffalo lymph is stated to have been popular wherever introduced, but no information has been furnished as to the places where it was introduced or its relative merits as compared with other lymph used by the department.

During the year under review the operations of the Vaccination Department of the Central Provinces were extended to 11 additional zemindaries, and, compared with the previous year, there was on an average an accession of seven vaccinators to the special establishment. In the past year, however, two feudatory states, with a population of over 259,000 inhabitants, failed to furnish returns. The total operations, nevertheless, increased from 391,742 in 1886–87 to 411,908 in 1887–88, and the average number operated on by each vaccinator from 1,726 to 1,745. Of these 393,987 were primary

cases with success at 96·08 per cent. against 369,409 cases and 95·48 per cent. of success in 1886–87; but the number of re-vaccinations decreased from 22,333 in 1886–87 to 17,921 in 1887–88. Besides these, 15,382 operations were performed by medical subordinates attached to dispensaries against 17,657 in the previous year, the success in these cases being 92·52 per cent. in primary operations and 72·40 in re-vaccinations, against 92·09 and 68·32 respectively in 1886–87. In all 182,330 infants under one year of age were successfully vaccinated.

Although the average number of vaccinators employed during the year in Berar was the same as the year before, and the total expenditure of the department as well as the average cost of each successful case was less, yet the total operations increased from 86,934 in 1886–87 to 87,993 in 1887–88, or, including Melghat, which with a population of 42,655 inhabitants was for the first time brought under the operation of the Vaccine Department in the year under review, to 90,311; and the average number performed by each vaccinator from 2,070 to 2,150. Of the above total 99·6 per cent. were primary operations, which proved successful in 96·5 per cent. of the cases, and the rest were re-vaccinations with success at 45·4 per cent. Besides these, 6,847 vaccinations were performed by medical subordinates in dispensaries against 7,238 in 1886–87; but in these the ratio of success claimed in regard to the secondary operations, viz., 83·6 against 58·3 per cent. in the preceding year, seems open to grave suspicion, especially as the inspection of the cases by the civil surgeons, except in Basim, was not carried out very satisfactorily. Of infants under one year of age, 72,638 were protected during the year against 68,223 in the previous year; but the ratio of successful cases per 1,000 of the total population fell to 35·2 from 35·6 in 1886–87.

During 1887–88 the special establishment of Lower Burma fell short by six vaccinators, yet the total number of operations increased from 64,184 in 1886–87 to 73,847 in the year under notice. Of these, 57,024 proved successful in primary cases, or at the rate of 87·27 per cent. and 5,369 in re-vaccinations, or at the rate of 63·11 per cent. In addition to these, 2,769 operations were performed by the medical subordinates attached to dispensaries with success at the rate of 75·69 per cent. in primary cases, and 62·62 in secondary operations. The total number of children under one year of age protected by this means in the first year was 16,661, or, assuming the birth and death registers to be correct, only about one-fourth of the infants born during the year. The average cost of each successful case was a few pies less than in the preceding year.

During the year under review the vaccination staff of Assam, including civil surgeons, hospital assistants, and compounders, consisted of 231 operators against 214 in 1886–87; and the total number of operations, including those carried on by the tea-gardens' agency, rose to 132,349 from 128,833 in the previous year. Most of the districts, but more prominently Lakhimpur and Darrang, participated in this increase. The decrease was confined to Sylhet, the Garo Hills, and Sibsagar. In the tea gardens also there was a falling off. But steps have been taken to arrest this retrogression. In the province as a whole there was a slight improvement in the proportion of successful cases in primary vaccinations, viz., 91·59 per cent. against 91·46 in 1886–87; but in the case of re-vaccinations the ratio of success fell to 79·08 per cent. against 79·86 in the preceding year. Although the Compulsory Vaccination Act was introduced in the municipalities of Gauhati and Sylhet in 1882, and in the cantonment and municipality of Dibrugarh in 1883, the results are yet far from satisfactory, and it is apparent that the provisions of the law are not duly enforced. Bovine lymph proved totally unsuccessful in the province. The total expenditure of the department amounted to Rs. 13,357 against Rs. 12,136 in 1886–87; but the cost of each successful case fell from an average of Rs. 0-2-$\frac{3}{4}$ to one anna and ten pies.

The report from Madras was not received in time to be included here.

During 1887–88 the vaccination establishment of Bombay was strengthened by the addition of one inspector, one assistant superintendent, and 16 vaccinators. This was followed by the increase of the total operations from 836,773 in 1886–87 to 869,187 in the year under review in primary cases, and from 44,988 to 47,231 in re-vaccinations; and the average number operated on by each vaccinator also rose from 1,822 to 1,852. The proportion of success in primary cases, however, was somewhat less than in the previous year, being 95·47 per cent. against 95·56; but in re-vaccinations the percentage of success in the two years was almost identical. Besides these, 9,256 operations were performed by medical subordinates attached to dispensaries with success at the rate of 92·68 per cent. in primary cases and 29·57 per cent. in re-vaccinations. Thus it will be seen that 925,674 operations were performed among the

civil population of the Presidency, of which 867,351 proved successful, or at the rate of about 33·8 per 1,000 of population. Of the children under one year of age 583,700 were vaccinated during the year. The Compulsory Vaccination Act is reported to have worked well both in Bombay and Karachi. The total cost of the department amounted to Rs. 2,72,076-9-2 against Rs. 2,80,176-7-6 in the previous year, and the cost of each successful case was comparatively less, having fallen from Rs. 0-5-5 to 0-5-1.

The total number of vaccinations performed in Coorg during 1887–88 amounted to 9,278 against 9,119 in 1886-87. Of these, 8,959 were primary operations successful in 8,364 cases, or at the rate of 93·35 per cent., and 319 were re-vaccinations successful in 245 instances, or at the rate of 76·80 per cent. In addition to these, 96 operations were carried out in the dispensaries, and of these 70 proved successful. These results show some improvement over the figures for the past year.

Sanitary Works—Military.

The total outlay on military works during the financial year 1887-88 amounted to Rs. 59,74,683 or Rs. 3,74,945 less than the expenditure incurred in the preceding year. A great portion of this outlay was devoted to works of a sanitary character.

The details of some of the works executed or undertaken during the year were as follows:—

Accommodation of Troops.—As in the previous year, a large expenditure was incurred for the accommodation of troops at Quetta, where the following works were carried out:—

(1.) The half-company hut barracks in the British infantry lines, of which seven had been finished during the year 1886-87, were practically completed, together with their cook-houses, lavatories, and latrines.

(2.) Quarters for thirteen families, and a sergeants' mess, both with out-offices, were completed in the Right British Infantry Lines.

(3.) In the Left British Infantry Lines, the subsidiary buildings for the band barrack, and for the married quarters, were built, and a quarter-guard and cells provided.

(4.) The subsidiary buildings for the single men's barracks of the Garrison battery, Royal Artillery, and for the Royal Artillery family quarters, were completed early in the year, and a quarter-guard and cells, with out-offices, were built in the same lines.

At Loralai the Native Cavalry barracks were completed at a total cost of Rs. 1,14,100.

At Peshawar the four new barracks for the Left British Infantry Lines are rapidly approaching completion; the work was delayed owing to the late arrival of iron girders from England.

At Cherat Nos. 12 and 16 concrete barracks were completed, and 12 hut barracks constructed.

At Rawal Pindi the hut type buildings at West Ridge for Institutes for two British Infantry Regiments and four batteries Royal Artillery were nearly completed, and the sergeants' messes were commenced.

Hutting at Hill stations.—Good progress was made during the year in the construction of hut type barracks at the various Hill stations, the following units being in hand or completed at the end of the year:—

In the Murree Hills	36	units	to hold 12 men each,	completed.
Chakrata	12	„	„	in hand.
Ranikhet	12	„	„	completed.
Subathu	12	„	„	in hand.
Dalhousie	12	„	„	in hand.

At Jhansi work was continued on the five heavy battery barracks, and their subsidiary buildings.

At Muttra the two half-troop barracks for the British Cavalry were completed, with their subsidiary buildings.

At Fyzabad the three new Royal Artillery barracks were completed at a cost of Rs. 1,29,651.

At Lucknow No. 3 married barrack in the Royal Artillery Lines was converted into a single men's barrack.

Accommodation for Officers.—But little expenditure was incurred under this head, the only items being :—

At Quetta, where the quarters for 18 unmarried officers of British Infantry Regiments were completed, quarters for the Major and Captain of the mountain battery built, and a house in cantonments purchased for officers ;

At Peshin, where two additional blocks of officers' quarters were constructed ; and

At Loralai, where an expenditure of Rs. 24,132 was incurred under this head.

Buildings for the Army Medical Department.—At Rawal Pindi, the station hospital was completed.

At Quetta two blocks, for 30 male patients each, in the station hospital were built.

At Barrackpore a large portion of the station hospital was burnt down in March 1887, from the effects, it is believed, of lightning. It has been reconstructed at a cost of Rs. 12,545.

Prison and Cognate wants.—At Lucknow the conversion of the old British Cavalry hospital into a military prison was completed, the total cost being Rs. 44,332.

At Nowgong the quarter-guard and cells for the Royal Artillery Lines, commenced in February 1888, were completed at a total cost of Rs. 16,481.

At Dagshai the gymnasium for British Infantry was completed.

Improvements and Renewals of Buildings.—Under this head, which includes all special repairs to buildings involving a change in style of construction, or renewals, the cost of which exceeds one quarter the book value of the building, a sum of Rs. 5,52,103 has been expended during the year.

This, however, includes Rs. 1,60,080 for four new barracks and their subsidiary buildings, charged to the Peshawar restoration scheme. The balance has been devoted to the substitution of Allahabad tile and sheet iron for thatch, shingle, and other inferior roof coverings, and to general restorations and improvements at Lucknow, Fyzabad, Meerut, Peshawar, Muttra, and other stations.

At Chakrata progress has been made on the water-supply scheme, the reservoir and filters above Morrow's neck being practically completed.

Civil Sanitary Works.

The only sanitary works of any magnitude executed or undertaken in Bengal during the year were the drainage scheme of the town of Dinagepore which was being carried out at the expense of the Maharaja of that place at an estimated cost of Rs. 26,000; the Surpai drainage works at Midnapur, on which Rs. 29,692 were expended during the year ; the erection of protective embankments in the same district, on which upwards of Rs. 10,000 were spent ; the Bhagalpur waterworks in which satisfactory progress was made during the year ; and the construction of a tramway at Howrah for removal of night-soil beyond the municipal limits. In the municipalities, on the whole, 56·93 per cent. of income was expended on sanitary works including roads; but in most of them the expenses were chiefly confined to sanitary works of an annually recurring nature. In 21 towns the expenditure on original sanitary works varied between 17 and 48 per cent. ; in 26 between 10 and 16 per cent. ; and in 67 between ·13 and 9·91 per cent., and in 25 towns nothing was spent on this account. It is encouraging to observe that during the year under review Rs. 1,39,041 was spent by charitably disposed persons on works of public utility, the main portion of it, Rs. 91,153, being laid out on improvement of water-supply, Rs. 11,152 on drainage, Rs. 5,276 on roads, and Rs. 31,460 on charitable dispensaries, poor-houses, and resting places for pilgrims and the destitute.

In the North-Western Provinces and Oudh the sanitary improvements were the following :—In the town of Dehra Dun the waterworks were approaching completion. At Mussoorie a conservancy scheme for the removal of night-soil has been completed at a cost of Rs. 23,363. At Saharanpur the drains have been completed at a great outlay, and the question of effectually flushing them is now under consideration. In Khurja several new roads were made with side drains. At Farukhabad, upwards of Rs. 19,000 was spent on sanitary improvements; out of this sum Rs. 8,000 was expended on drains. At Moradabad a fine masonry drain was constructed from Deberia tank to Ramgunga. At Amroha and Sambhal much useful sanitary work was carried out, and the drainage of Sambhal was being improved at considerable expense. At Allahabad, Rs. 78,603 was spent for sanitary purposes, and Rs. 12,00,000 has been sanctioned for waterworks. At Ballia, a drainage scheme has been carried out to facilitate the flow of water from the town in the rains. At Gorakhpur the

drainage of the Ramghar Tal was carried out, and several latrines and urinals were erected. At Lucknow, 11 new latrines and upwards of 24,000 feet of masonry drains were constructed, 188 wells were cleaned and deepened, and the sinking of an artesian well was in progress. At Hardoi the drainage scheme was progressing. At Fyzabad upwards of Rs. 18,000 was spent on the construction or repairing of drains and latrines, cleaning 515 wells, and other sanitary purposes. Besides these, a most important drainage scheme, called the "Karwan Nadi Improvement," was being carried out in the Muttra and Agra districts, involving an expenditure of Rs. 86,000, of which some Rs. 20,000 has been given by landed proprietors. This Karwan Nadi is a main drainage line of the country, having its rise in the Khurja Pergunnah of the Bulandshahr district, and flowing through the Tehsils of Khurja, Khair, Iglas, Hattras, Saidabad and Ferozabad, and falling into the Jumna below Agra. The portion improved last year measured 54 miles in the pergunnahs of Hassangarh, Gori, Mursan, and Saidabad, and should the upper portion of the channel in the Khair and Khurja Tehsils be subsequently taken in hand, the benefit to all that tract of the Doab will be incalculable.

The following is a short summary of the main sanitary works which have either been completed or undertaken, or were under consideration during the year in the Punjab. In the Rohtak district the Jua drain was improved, and a large drainage channel to prevent flooding in the Gohana and Rohtak Tehsils was in progress. In Gurgaon the Khalilpur dam was taken in hand at an estimated cost of Rs. 20,000, and more than half the amount was already spent on it during the year. In Delhi city the water and drainage schemes were still under consideration, and upwards of Rs. 10,000 were expended in constructing several underground street drains. In the Karnal district the carrying out of the general drainage scheme was in progress, and plans and estimates for carrying out the Paniput suburban drainage works were under preparation. In Umballa Rs. 2,028 were expended in paving the streets of Shahabad and Sadhaura towns, and a scheme for supplying the city of Umballa with pure water was under consideration. In Jullundur, a project for the drainage of the town was being considered in the Public Works Department, and an estimate was being prepared for improving two tanks. At Loodhiana Rs. 6,268 were expended in constructing masonry drains, and a general scheme for draining the town was under consideration. At Mooltan, Rs. 8,684 were spent in repairing and cleaning out wells, and Rs. 1,045 in repairing drains and sewers. In the Lahore district street drains were constructed at Kasur at a cost of Rs. 2,988, and in Lahore city, three streets in the Anarkali Bazaar were drained, and some drains in the city itself were repaired at a cost of Rs. 2,299, and schemes for the general drainage of the Anarkali Bazaar, together with the civil station and the suburb of Mozang, were under consideration. At Amritsar, Rs. 41,652 were spent in converting a part of the city ditch into pleasure grounds. In the Gujranwalla district the drainage scheme for the city of that name was taken in hand at an estimated cost of Rs. 43,552, and the question of supplying water in pipes to Wazirabad from the Chenab was under consideration. At Sialkot a scheme was in hand for supplying pure water to the city, and Rs. 14,822 were expended in constructing a circular drain, and Rs. 2,103 on repairs of street pavement. At Rawal Pindi the waterworks were completed, and plans and estimates were ready for building up the main drain of the city with masonry through its whole length. At Peshawar a number of open and covered drains was constructed at a cost of Rs. 8,940, and the waterworks scheme was under the consideration of the Government. In the municipalities on the whole, excluding Dera Ghazi Khan, from which no returns have been received, Rs. 10,92,075, or including vaccination Rs. 11,12,049, or 26 per cent. of income, were spent on sanitation. The practice of using night-soil as manure is now adopted more or less all over the Punjab, and has become a fruitful source of income to the municipalities. In 1887 their receipts on this account amounted to Rs. 99,319 against Rs. 89,483 in 1886.

No large sanitary work was carried out in the Central Provinces during the year, but in the larger towns more or less was done to improve their sanitary condition. A fair share of the income of the municipalities was spent on conservancy arrangements, but the outlay on drainage and waterworks was not general, and in the towns where they were attended to, the expenditure in most of them was too inadequate to secure any substantial benefit to the inhabitants. Throughout the whole province, 266 new wells were constructed and 26 old ones were repaired. During the year under review the question of village sanitation received a good deal of attention from the village headmen, and the special sanitary rules which at first had been "made applicable to "villages within a few miles' radius of a few headquarter stations were during the

" year extended to all villages having over 50 inhabitants." It is satisfactory to find that by a perusal of the district reports for the past year the Chief Commissioner is enabled to say that " there is no doubt that more attention is now paid to village " cleanliness and to conservation of the village water from impurities than ever " before."

The sanitary improvements executed or undertaken during the year in Berar included works carried on by the Public Works Department, district officers, and municipalities. The cost of original works and repairs carried out by the Public Works Department in West Berar division amounted to Rs. 4,848. In the East Berar division the waterworks at Amraoti were proceeded with and four anicuts (weirs) were completed. In the districts, excluding municipalities, Rs. 1,03,389 were spent on sanitary improvements against Rs. 93,685 in the previous year. Of the above total, Rs. 23,776 were expended in civil stations, Rs. 28,520 in non-municipal towns, and Rs. 51,093 in villages. The amounts expended on different items were in the proportion of 29 per cent. on conservancy, 22 on drainage, 18 on water-supply, and 30 on other sanitary works. In the municipalities Rs. 84,155 or 47·1 per cent. of total income were devoted to sanitary purposes, in the proportion of 21·1 to conservancy, 3·6 to drainage, 8·5 to water-supply, and 13·9 to other sanitary improvements. No work of any magnitude was undertaken during the year. A scheme for supplying the town of Akola with pure water-supply is under consideration.

There is very little to record in Assam under the head of sanitary improvements. The total income of the municipalities, unions, &c., in 1887 was only Rs. 1,47,229. Of this the outlay on sanitation amounted to Rs. 74,366, or a total expenditure of about 50 per cent. of the income.

No appreciable sanitary improvements have yet been begun in the villages of Burma. In the towns, on the whole, a fair proportion of their income was utilised in carrying out sanitary reforms during the year. The money so spent amounted in all to Rs. 87,692. But, besides the commencement of the drainage works and the reclamation of low-lying lands in Rangoon, all the other works executed or undertaken were of an ordinary nature.

No sanitary works of any importance appear to have been carried out in Madras. In 1887–88, Rs. 6,20,571 were sanctioned by the municipalities and Rs. 4,12,940 were granted by the district boards for sanitary purposes, but up to the end of December 1887 (nine months) only Rs. 4,07,727 and Rs. 2,31,730, respectively, were expended. Of the total outlay on sanitation, more than one-half was expended on conservancy arrangements, and the balance on carrying out vaccination, improving village sites, constructing or repairing drains, latrines, markets, slaughter-houses, roads, dust-bins, cinerators, &c., and improving sources of water-supply by constructing new wells and tanks or cleaning and repairing the old ones, &c. It is stated that water-supply schemes were in preparation in Madura, Salem, Negapatam, Tanjore, &c., and drainage schemes in Negapatam and Kumbakonum.

In the municipalities of Bombay, on the whole, about 21 per cent. of their income was spent on conservancy arrangements. Ordinary works for improving water-supply, drainage, roads, &c., and providing cesspools, latrines, urinals, markets, &c., were carried out during the year in most of the towns. But of the sanitary works which were executed or undertaken during the year or were in contemplation, the following are important. At Ahmedabad a project was in hand to supply the city with pure water-supply at a cost of Rs. 6,00,000. At Kalyan a design for laying the Tansa water pipes to the town was under consideration. At Ahmednagar the improvement of the water-supply was being carried on at a cost of Rs. 12,000. At Dhulia a scheme for supplying the town with good water has been approved. At Yeola the construction of waterworks was about to be taken in hand. At Nasik plans and estimates have been made to supply good drinking water to the town. At Telegaon Dabhada a new tank was built at a cost of Rs. 43,000. At Sholapur the total expenditure on account of water amounted to Rs. 34,279 during the year, and on new drains Rs. 2,614. At Athni a tank for drinking was deepened at a cost of Rs. 7,675. At Panvel arrangements have been made for constructing the new waterworks. At Karachi the waterworks of the city were largely extended at a cost of Rs. 15,270, and a scheme for drainage was under consideration. An improved system of drainage was also under consideration at Tatta. At Hyderabad the work of draining off foul water from the water services on the east of the city was in progress. At Sukkur two underground drains were improved, and plans and estimates for improving the others were in hand. At Poona Rs. 58,983 were expended on vegetable and fruit market. The local fund

boards also spent large sums on sanitary works, chiefly consisting of the provision of new tanks and wells or repairing old ones.

No sanitary work of any importance was executed or undertaken in Coorg during the year under review. Only some wells were sunk, roads were metalled, and drains were constructed or repaired here and there.

General Remarks.

Health of Haj pilgrims in 1887.

The number of pilgrims who attended the Haj of 1887 was unusually large, the gathering on Mount Arafat on the 28th of August being computed by the local officials at 150,000 persons. The excess was chiefly due to an influx of Arabs and Bedouins from the surrounding districts; but the total number of pilgrims who arrived by sea was 46,020, which is 4,000 more than in the previous year, though less than in 1885. The arrivals by sea have increased greatly in the last few years, the total number in 1882 having been 25,580. The number of pilgrims classed as Indians amounted in 1887 to 10,324. This includes persons who actually come from India as well as those from Central Asia who pass through India. The number of steamships that brought pilgrims from all parts was 134.

The heat at Muna was unusually great, and there were many deaths from sunstroke and from ordinary causes, such as diarrhœa, dysentery, and fever; but there was no outbreak of cholera or other violently destructive or epidemic disease. There has now been no outbreak of cholera since 1883. This immunity is attributed by Assistant Surgeon Abdur Razzak, Khan Bahadur, Her Britannic Majesty's Vice-Consul at Jeddah, to the improved sanitary arrangements for cleansing the towns of Muna and Mecca, especially the prompt burial of the carcasses of slaughtered animals at the former place, and also to the use of pure water by the pilgrims, stringent orders having been issued by the late Vali Osman Pasha to empty all the water tanks in the town of Muna before the Haj, so that the pilgrims are compelled to use the water brought into the town by a branch from the Zobeida aqueduct.

Provincial sanitary boards.

Appendix "A" to this report is a reprint of a Resolution of the Government of India in the Home Department on the application of sanitary principles to towns and villages in India,* in which it is directed that a Sanitary Board is to be formed in every province, and is to be not merely a consultative body, but the executive agency through which the Local Government will act in the Sanitary Department. The formation of these Provincial Sanitary Boards marks a new epoch in the history of the Sanitary Department, and will lead, it is hoped, to greater rapidity in the progress of sanitary reform throughout India.

Memorandum on cholera.

In Appendix "B" will be found a valuable memorandum on "Cholera as a Preventible Disease," by Surgeon-Major Hutcheson, Officiating Statistical Officer to the Government of India, which embraces and summarises the statistics of cholera in the cantonments and jails of Bengal for the past 30 years. It is demonstrated that the mortality from cholera in the European and Native armies, and among prisoners confined in jails, has declined to a remarkable extent in recent as compared with former years. This marked and progressive decline in the mortality from cholera and the ever-widening period of incidence and lessening virulence of the disease among these communities indicates the utility and beneficial results of the sanitary measures enforced in the cantonments and jails of Bengal, and the data brought together in this memorandum should prove of great service in promoting and encouraging sanitary reform throughout India.

Scientific memoirs.

The fourth part of the "Scientific Memoirs," which is published coincidently with this report, contains the following papers:—

(1.) "Are choleraic comma-bacilli, even granting that they are the proximate cause "of choleraic symptoms, really efficient in determining the epidemic diffusion "of cholera?" by Surgeon-Major D. D. Cunningham, M.B.

(2.) "Notes on the life-history of Ravenelia sessilis, B., and Ravenelia sticta, B. "and Br.," by Surgeon-Major D. D. Cunningham, M.B.

(3.) "On the life-history of a new Cæoma on Smilax aspera, Linn.," by Surgeon-Major A. Barclay, M.B.

(4.) "Are venomous snakes auto-toxic? An inquiry into the effect of serpent-"venom upon the serpents themselves," by Surgeon L. A. Waddell, M.B.

* This Resolution was reprinted in the Report on Sanitary Measures in India in 1886-87 [C. 5533], pages 38 to 42.

In the first of these papers Dr. Cunningham deals with the results of a series of experiments on the behaviour of choleraic comma-bacilli in soil and water of various qualities, and shows that, under ordinary circumstances, even in an endemic locality such as Calcutta, there is very little probability of their multiplying to any great extent or persisting for any prolonged period in soil or water to which they may gain access. It further appears that this is due to their incapacity to hold their own in the struggle for existence to which they are exposed with the schizomycete and other organisms normally present in the media, as where the latter are sterilised the persistence and multiplication of commas occur just as it would do in any artificial sterilised medium of suitable quality. Dr. Cunningham, taking these results along with others of a similar nature obtained by other observers as a basis, argues that, even should it be granted that the comma-bacilli are the efficient cause of choleraic symptoms, they must be regarded as holding a very secondary place in the causation of epidemic diffusion of the disease, and that it is peculiarities in conditions of locality which must be regarded as of primary importance, seeing that without these the bacilli would neither be able to establish themselves in sufficient numbers and with sufficient persistence, nor be able, even could they do so, to affect the population in epidemic proportions. The practical conclusion which is arrived at is that it is to improvements in local sanitation, and not to the enforcement of quarantine regulations, that we must look as a means of preventing the occurrence of spreading epidemics.

APPENDIX B.

MEMORANDUM ON CHOLERA AS A PREVENTABLE DISEASE, BY SURGEON-MAJOR G. HUTCHESON, M.D., OFFICIATING STATISTICAL OFFICER TO THE GOVERNMENT OF INDIA IN THE SANITARY AND MEDICAL DEPARTMENTS.

That cholera is a preventable disease is clearly demonstrable. The average mortality among European and Native troops of the Bengal Presidency, and of prisoners confined in Bengal jails, has diminished to an enormous and almost incredible extent within recent years. The actual number of deaths from cholera and the ratio of mortality per 1,000 of average strength in the European and Native armies and in the jails of Bengal from 1858 to 1887, a period of 30 years, are accurately shown in the following tables:—

TABLE A.

	Deaths from Cholera from 1858 to 1872, 15 Years.	Deaths from Cholera from 1873 to 1887, 15 Years.	Number of Deaths in 30 Years.
European Army of Bengal - - -	4,923	1,647	6,570
Native Army of Bengal - - - -	2,244	1,146	3,390
Jail population of Bengal - - -	6,465	3,071	9,536

TABLE B.

	Strength from 1858 to 1872.	Mortality from Cholera per 1,000 of Strength.	Strength from 1873 to 1887.	Mortality from Cholera per 1,000 of Strength.
European Army of Bengal -	595,383	8·27	547,301	3·01
Native Army of Bengal -	873,713	2·57	852,337	1·34
Jail population of Bengal -	813,830	7·94	939,114	3·27

The average mortality per 1,000 of strength among Europeans in the Bengal Presidency was 175 per cent. more during the first period of fifteen years from 1858 to 1872, than during the second period from 1873 to 1887. During the earlier years of the British occupation of the Province the average annual ratio of deaths per 1,000 among European troops from this single cause was more than three times what it now is, or 200 per cent. over the average of the past 15 years. Within the period of accurately recorded statistics, namely, from 1858 to 1887, and during the first 15 years from 1858 to 1872, the ratio of mortality from cholera was 8·27 per 1,000 of strength per annum, while during the past 15 years, from 1873 to 1887, the ratio of mortality has actually declined to 3·01 as tabulated. This great and most marked diminution in the mortality from cholera among European troops, corresponds with an approximate diminution in the mortality from the same cause among Native troops, and the prisoners confined in Bengal jails. That this lessening mortality is real, and not a mere statement based on inaccurate statistics, and the manipulation of figures, is proved by the gradual diminishing number of deaths year by year from this cause, in all the important stations of the Bengal Presidency, and among communities regarding whom the vital statistics are as accurate as any other community in the civilised world.

Not only has the total mortality from cholera greatly diminished, but a comparison of the number of deaths from this cause, in all the principal stations of Bengal, shows that all the important cantonments enjoy an immunity from cholera unknown in former years. A notable instance is furnished by the European garrison of Fort William. This garrison, during the 25 years from 1838 to 1862, returned 492 deaths from cholera, while during a like period of 25 years from 1863 to 1887, only 36 deaths have been recorded, although the average strength has remained about the same for both periods.

The enormous decrease in the mortality from a single cause is not confined to any one location or garrison; for a corresponding relative decrease is apparent, as already

stated, in nearly every cantonment and garrison of Bengal. During the quarter of a century from 1838 to 1862, the garrison of Dinapore returned 236 deaths from cholera, while during the 25 years from 1863 to 1887, only 61 deaths from the same cause have been placed on record.

It is thus clearly shown that two European garrisons, with vastly different locations and surroundings, have each a relatively very marked immunity from cholera within recent as compared with former years. The mortality in the Calcutta, or Fort William, garrison from cholera alone was over 1,300 per cent. or 13 times greater during the earlier period (quarter of a century) from 1838 to 1862, than it was during the later period (quarter of a century) from 1863 to 1887.

The immense improvement in the cholera statistics of the European and Native armies and jails of Bengal, is most marked within very recent years, that is, within the period of carefully compiled and accurately recorded statistics dating since 1858. It is during this period of 30 years that the rapid and extensive melioration in the incidence of cholera is most observable. The possibility of lessening the incidence of epidemic cholera is unquestionably proved, by the indisputable and undeniable facts placed on record by the Government of India, and tabulated with every care for half a century. The record of cholera is the record of one of the most preventable of epidemic diseases. The rapidly diminishing incidence of cholera, among the protected communities of Bengal, is proof of the capability of modern sanitary science to mitigate the disease in every province and district of the Empire.

Until recently, vital statistics of the general population of India have been irregularly and incorrectly tabulated; and even an approximate to the actual mortality from cholera is not indicated by the record. The mortality from all causes has been understated, and previous to 1870 the figures were to a very great extent fallacious. The difference of method also, in obtaining the mortuary statistics, and in compiling returns in the various provinces of the Indian Empire, rendered any attempt at correct comparison between the figures of the different provincial returns impracticable. It is noted in the Tenth Annual Report of the Sanitary Commissioner with the Government of India for the year 1873, that the ratios of mortality are not given for Lower Bengal, as the registration of deaths in that province "is still most "imperfect." In 1874 the registration was still characterised "as very imperfect. "No ratios, therefore, are given." Since then, however, registration in all provinces has progressed satisfactorily, and with some attempt at accuracy. The following table shows the mortality from cholera throughout the general population of India from 1875 to 1887, as registered in each province. It serves to show the incidence of cholera throughout India and Lower Burma during 13 years, when registration was carried out with some efficiency. The record approximates only to the truth, and the table represents the general incidence of and not the actual mortality from, cholera. The enormous totals, representing deaths from a preventible disease and one single cause, are sufficiently striking.

II.

Annual Deaths from Cholera in India, 1875 *to* 1887.

——	Population.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Bengal	66,163,884	109,988	196,590	155,305	95,192	136,363	39,643	79,180	182,352	90,439	134,421	173,767	118,368	172,578
Assam	4,526,959	6,618	8,615	11,377	6,732	17,415	2,803	5,010	21,055	14,908	22,276	7,753	20,188	7,941
North-Western Provinces and Oudh.	44,107,869	64,427	48,311	31,729	22,221	35,892	71,546	25,865	89,372	18,166	30,143	63,457	34,565	200,628
Punjab	18,842,264	6,246	5,736	29	215	26,135	274	5,207	39	199	614	1,936	12	8,804
Central Provinces	8,817,185	14,643	20,124	3,418	40,985	27,575	330	9,140	11,932	16,235	149	21,868	16,679	12,576
Berar	2,630,913	22,465	2,683	842	34,306	223	1	3,404	3,573	27,897	87	3,683	976	14,396
Rajputana	*	1,203	283	60	2,393	918	—	197	1,327	797	1,297	1,695	173	2,612
Central India	*	2,555	1,929	926	8,047	2,734	299	581	1,562	1,740	1,018	4,624	290	8,868
Bombay	16,454,414	47,573	32,117	57,228	46,743	6,937	684	16,694	7,904	32,954	13,804	37,287	167	25,711
Hyderabad	*	10,891	5,582	7,414	6,696	6	—	1,721	150	1,947	2,479	1,887	499	2,531
Madras	28,048,538†	94,547	143,189	357,430	47,167	13,296	613	9,446	23,604	36,284	75,476	58,109	12,417	28,359
Mysore	4,092,648	2,504	12,087	2,902	723	14	25	25	893	124	330	2,677	10	832
Coorg	178,302	‡	210	‡	49	—	—	3	31	—	—	—	—	3
Lower Burma	3,653,629	761	3,678	7,276	6,759	1,828	2,638	5,239	7,177	2,185	5,515	7,685	4,027	2,649

* Not known. † Exluding Europeans and Eurasians. ‡ Not recorded.

While the mortuary returns of the general population are still incorrect and incomplete, and the registration of the actual mortality remains imperfect, the vital statistics of the European and Native armies of India, and of prisoners confined in Indian jails are as accurate and complete as professional skill and scientific labour can make them. The weekly, monthly, and annual sick returns of troops and of the jail population in India are compiled in accordance with the most approved methods of modern statisticians; and the classification and nosological standards of the representatives of the medical profession of all England are strictly adhered to in the tabulation of such returns. It is on such accurately recorded data that the information furnished, and the views propounded in this note, are based.

During the period from 1858 to 1887, the total number of deaths from cholera recorded among European troops in Bengal was, as stated, 6,570.

Except during 1879, the condition of the European army of Bengal, both as regards location and movement, has been more or less normal with respect to its liability to cholera. In 1879, however, a large force was employed in Afghanistan and on the routes leading to Kabul and Kandahar; and the casualties from cholera alone, among the Europeans of that force, amounted to a total of 374. If we properly exclude this number from the mortality of the year, 253 deaths represent the total mortality during that year among European troops living under ordinary conditions within the Presidency. Even including such figures, although they should for obvious reasons be excluded as the mortality which occurred in the field forces of Northern and Southern Afghanistan was exceptional, there is a most marked difference between the mortality of the first 15 years and the 15 succeeding years. The difference is thus shown:—

European Troops.

Total number of deaths from cholera, from 1858 to 1872 inclusive - - - - -	4,923
Total number of deaths from cholera, from 1873 to 1887 inclusive - - - - -	1,647

If we exclude, fairly enough, the number of deaths which occurred in the field forces of Northern and Southern Afghanistan in 1879, the mortality from cholera among European troops during the last 15 years is represented by the comparative small number of 1,273 as compared with 4,923 during the previous 15 years, or stated in other words, the average mortality from cholera among the European troops of Bengal was 287 per cent. more during the earlier than during the later period. Even if the casualties among the forces in the field and on active service be included, the enormous reduction in the mortality, and the immunity from cholera in recent years, are sufficiently evident. Careful analysis and systematic explanation of the data submitted will render the facts more patent and indisputable.

The history of cholera among the European troops of Bengal is the history of the disease by individual stations. Seven cantonments return over one-half of the total number of deaths during the period of 30 years, from 1858 to 1887. Thus, the total number of deaths during the period was 6,570, and the following cantonments returned 3,292, or more than half of the total mortality:—

	Deaths from 1858 to 1887.	Ratio per 1,000 of strength.
Meean Meer - - - -	753	23·50
Peshawar - - -	668	13·23
Allahabad - - -	501	16·20
Morar - - -	438	14·36
Lucknow - - -	396	5·93
Meerut - - -	288	5·77
Agra - - - -	248	8·13
	3,292	

If the mortality from cholera in these seven stations, during the period of 15 years from 1858 to 1872, be compared with the mortality during the next period from

1873 to 1887, the relative decrease corresponds with, and is in excess of, the total decrease throughout the army of Bengal, thus :—

	Mortality from Cholera.			
	From 1858 to 1872, 15 years.	Ratio per 1,000 of Strength.	From 1873 to 1887, 15 years.	Ratio per 1,000 of Strength.
Meean Meer	661	35·26	92	6·92
Peshawar	517	18·09	151	6·89
Allahabad	407	24·96	94	6·43
Morar	359	24·13	79	5·09
Lucknow	259	7·86	137	4·05
Meerut	248	9·22	40	1·74
Agra	227	14·62	21	1·40
	2,678	17·40	614	4·48

The great relative decrease in the mortality in these seven important cantonments, in recent as compared with former years, is very marked; and the lessening incidence of cholera in these stations is represented by the large figure of nearly 300 per cent. more casualties within the period of 15 years from 1858 to 1872 than during the past 15-year period from 1873 to 1887. Further, in tabulating the mortality of six other stations, in which over 100 deaths from the disease are recorded within the 30-year period, it is shown that there is the same relative, and even a greater, decrease in the average number of casualties and ratio of mortality :—

	Mortality from Cholera.			
	During 15 years from 1858 to 1872.	Ratio per 1,000 of Strength.	During 15 years from 1873 to 1887.	Ratio per 1,000 of Strength.
Cawnpore	175	12·52	36	3·04
Fort William	145	10·82	16	1·17
Benares	136	10·65	21	3·17
Dum-Dum	133	12·61	6	·62
Delhi	100	8·71	7	1·02
Umballa	79	3·64	24	1·05
	768	9·16	110	1·54

This enormous decrease in the mortality from cholera in these six stations is almost incredible. The mortality during the first period was about 500 per cent. more than during the second period.

The mortality from cholera, among European troops in stations of the endemic area, is thus shown :—

	Mortality from Cholera.			
	During 15 years from 1858 to 1872.	Ratio per 1,000 of Strength.	During 15 years from 1873 to 1887.	Ratio per 1,000 of Strength.
Fort William	145	10·82	16	1·17
Dum-Dum	133	12·61	6	·62
Barrackpore	62	5·99	2	·43
	340	9·91	24	·86

The immunity from cholera enjoyed by European troops, within the endemic area, is as 24 to 340, or to state it more accurately, as ·86 to 9·91. In other words, the average mortality was over 1,000 per cent. more within the first period than during the later period—a demonstration of the far-reaching probability of stamping the disease out from among the general population to the same enormous, or even to a far greater, extent.

The vast improvement shown in the case of European troops with regard to their liability to cholera, corresponds with a marked diminution in the mortality from the same cause among Native troops and the prisoners confined in Bengal jails.

During the first 15-year period, from 1858 to 1872, 7·94 deaths per 1,000 from cholera alone were recorded among the jail population of Bengal, while during the 15 years from 1873 to 1887, the ratio per 1,000 fell to 3·27, or over 50 per cent. within recent years. In all 6,465 prisoners died from the disease from 1858 to 1872, while only 3,071 deaths were returned from 1873 to 1887.

The Alipore Jail, with its location on a typical cholera site, with the disease ever raging around it, and within the endemic area, recorded 331 deaths, a ratio of 10·74 per 1,000, during the period from 1858 to 1872, and only 129, equal to a ratio of 3·98 per 1,000, from 1873 to 1887. So, too, we find that, with the exception of three, the jails of Lower Bengal, which returned a mortality of 100 or over, during the past 30 years, now show a greatly diminishing incidence of the disease, thus :—

Jails.	Mortality from Cholera.			
	During 15 years from 1858 to 1872.	Ratio per 1,000 of Population.	During 15 years from 1873 to 1887.	Ratio per 1,000 of Population.
Hooghly - - -	270	29·77	75	11·44
Purnea - - -	231	43·31	18	5·70
Backergunge - -	192	28·22	73	11·54
Cuttack - - -	168	30·83	16	4·16
Midnapore - -	182	17·33	80	5·65
Patna - - -	173	23·64	59	12·43
Chupra - - -	129	24·34	45	11·72
Mozufferpore - -	122	20·74	58	11·75
Monghyr - - -	120	20·84	37	9·24
Arrah - - -	109	19·05	43	10·68
Chyebassa - - -	96	44·96	25	17·25
Gya - - -	76	11·78	57	10·14
	1,868	24·67	586	9·35
Bhagulpore, Central, and District jails.	186	28·32	202	11·71

The jails of Lower Bengal, which form the exception, and show an increase instead of a decrease, are—

Jails.	Mortality from Cholera.			
	During 15 years from 1858 to 1872.	Ratio per 1,000.	During 15 years from 1873 to 1887.	Ratio per 1,000.
Hazareebagh - -	149	15·64	184	19·57
Dacca - - -	48	6·10	77	7·20
Champarun - -	36	10·53	114	27·62

The exceptional increase in the mortality of these jails will form the subject of remark hereafter.

The total mortality of the 16 jails noted within the 30-year period, was over one-third of the whole recorded mortality from the disease among the jail population of the

Bengal Presidency, including the Central Provinces. The diminution in the mortality generally from cholera in the jails of Lower Bengal corresponds very closely with the diminution throughout the whole jail population.

	Mortality from Cholera.			
	During 15 years from 1858 to 1872.	Ratio per 1,000 of Population.	During 15 years from 1873 to 1887.	Ratio per 1,000 of Population.
In 16 jails of Lower Bengal each showing a mortality of 100 and over in 30 years.	2,287	22·29	1,163	11·17

or as stated for the jail population of the whole of the Bengal Presidency, a diminution in the number of deaths, and in the average ratio of mortality within recent years of very nearly one-half.

The comparative excellence of the sanitary arrangements and condition of the jails of the North-Western Provinces, and consequently the generally low mortality from all causes in these jails, would naturally lead to the supposition that any diminution in the mortality from a preventible disease like cholera would be most marked in a community more or less strictly guarded by sanitary precautions. The lessening incidence of cholera accordingly is nowhere shown and indicated more clearly than by reference to the vital statistics of the jails mentioned. There are only six jails which have returned over 100 deaths in 30 years; and with one exception the mortality from cholera has receded in most cases in as great a ratio of diminution as has marked the best-protected communities of European soldiers in the Presidency. The total number of deaths among the prisoners confined in the jails of the North-Western Provinces and Oudh, during the 15 years from 1858 to 1872, was 1,585, or an average ratio of 5·13 per 1,000 of population, while during the period from 1873 to 1887 only 395 deaths, or an average ratio of ·97 per 1,000, are shown. The great diminution in the casualties of those jails from a single cause is in the proportion of 5 to 1, or in other words the average ratio of mortality from cholera in the North-Western Provinces jails was five times, or 400 per cent. more than, the average ratio of the past 15 years, during the preceding 15 years from 1858 to 1872. Such a measure of improvement is more or less astounding; and the diminution in the ratio of mortality in the six jails which return 100 deaths, including Gorakhpur, where little improvement is noted, is as 7·95 to 1·81, or to put it more practically the mortality in these jails was four times, or over 300 per cent. more than, the average of the past 15 years, during the preceding period from 1858 to 1872. Thus:—

Jails.	Mortality from Cholera.			
	During 15 years from 1858 to 1872.	Ratio per 1,000 of Population.	During 15 years from 1873 to 1887.	Ratio per 1,000 of Population.
Agra	325	10·98	97	2·65
Meerut	247	11·20	17	·78
Lucknow	197	6·77	23	·66
Allahabad	148	4·75	9	·24
Benares	103	4·80	53	1·64
Gorakhpur	116	12·02	113	12·04
	1,136	7·95	312	1·81

The comparative immunity from cholera of the prisoners confined in the Peshawar Jail is in surprising contrast with the large number of casualties among the Europeans comprising the garrison of Peshawar. The Peshawar Jail, within the period of 30 years, returned only 51 deaths from the disease; and of this number 47 occurred

within the first period, and only 4 within the past 15 years from 1873 to 1887. The comparative immunity enjoyed by prisoners is thus shown :—

	Ratio of Mortality from Cholera.	
	Per 1,000 of Strength from 1858 to 1872.	Per 1,000 of Strength from 1873 to 1887.
European troops, Peshawar garrison - -	18·09	6·89
Prisoners, Peshawar Jail - -	6·87	·48

Of the other jails of the Punjab, the Umballa jail returned 20 deaths within the first period and none within the second. None of the Punjab jails, with the exception of the Lahore jails, returned over 100 deaths during the period of 30 years.

The Lahore jails combined returned a total of 248 deaths within the 30-year period; and of that number 74 only were recorded from 1858 to 1872, while 174 occurred within the 15 years from 1873 to 1887. These jails, as we have already seen, recorded a higher average mortality within the past 15 years than the Alipore jail, situate in the centre of cholera districts, and encompassed by the disease every day and month of the year, while the population in and around the Lahore jails may be free of the disease for consecutive years.

	Mortality from Cholera.			
	Deaths during 15 years from 1858–72		Deaths during 15 years from 1873–87.	
	No.	Ratio per 1,000.	No.	Ratio per 1,000.
Alipore jail - -	331	10·74	129	3·98
Lahore jails - - -	74	2·28	174	4·70

Such an exception to the ratio of general improvement, observed everywhere else in the Presidency of Bengal, will be noticed with reference to another view of the subject.

The general table of mortality among European troops shows that there were 11 years during the first period in which over 100 deaths from cholera were recorded, and eight years in which the disease may be said to have been severely epidemic, and in which over 350 deaths were noted. On the other hand, during the more recent period from 1873–87, there were only six years in which the deaths from cholera exceeded 100, and only one, a very exceptional year, 1879, in which the number of deaths exceeded 350. The exceptional mortality in 1879 was, as previously stated, due to the number of casualties in the field forces of Northern and Southern Afghanistan; and, if this unusual and distinctly separate fatality from cholera be excluded, there was no year of the later period in which the disease can be said to have been severely epidemic. In other words, cholera was severely epidemic in eight years of the first period, and once only in an exceptional year of the later period; and while there were 11 years of the first period in which over 100 deaths were recorded, there were only five years in the second period in which over 100 deaths were returned. Again, during the later period no station shows 100 deaths during any one year, and only three stations show a mortality of over 50, while during the former period, from 1858–72, five stations note over 100 deaths in different years, and in 21 different stations are over 50 deaths recorded. The highest mortality in any one year in any station of Bengal, during the period from 1858 to 1872, was 450; while during the period from 1873 to 1887, the greatest mortality in any station in any one year was only 89.

During the first period, the jails of Bengal recorded an annual mortality of over 200 during 13 different years; while during the period from 1873 to 1887 over 200 deaths are recorded in four years only. Again, in the Native army of Bengal during the first period there were nine years in which a mortality of over 100 deaths was

recorded, while during the second period in only two years were over 100 deaths returned. Further, including the total deaths among European and Native troops and of prisoners confined in Bengal jails, the mortality in 12 different years of the first period, from 1858 to 1872, exceeded 500, while during the period from 1873 to 1887 there were only two years in which the collective or combined mortality exceeded 500. The fact is incontestable that the mortality from cholera in Bengal, in every more or less protected community, has diminished enormously within the past 15 as compared with the preceding 15 years. Excluding the year 1879, with its exceptional mortality outside the Presidency, the European troops forming the army of Bengal have in no year of the later period suffered from the constantly recurring annual epidemics of the previous period; and the same statement is likewise applicable as regards the lessened incidence of the disease among Native troops and the jail population. Not only has the incidence of the disease been materially and enormously lessened, but the constantly recurring epidemics of the disease have been curbed, and the disease held in check for extended and ever-widening periods beyond its endemic area.

The widening period of the incidence of the disease is well illustrated as regards Peshawar, a station of importance, by the fact that no death among European troops was recorded from 1881 to 1886 inclusive, a period of six years, and among Native troops or prisoners from 1881 to 1887 inclusive, a period of seven years. The longest interval between the recurrence of cholera at Peshawar during former periods was four years. This fact is probably more fully explained by the long intervals of freedom from cholera now enjoyed by some jails of the North-Western Provinces and Oudh, and of the Central Provinces. The Sultanpore and Rai Bareilly jails have not returned a death from cholera for 14 years, the Mandla and Saugor jails not for 12 and 10 years respectively. The European garrison of Jubbulpore in the Central Provinces, which returned deaths from cholera within a four-or-five-year period in former times, has only recorded 2 deaths, both in one year, during the past 14 years. Barrackpore, with its 2 deaths only from cholera, Dum-Dum with its 6, and Fort William with its 16 only during the past 15 years, cannot under any system of reasoning be within the area of origin of such a deadly and, as assumed, everywhere disseminated aerial poison. The supposed deadly influence is proved to be more or less innocuous to the unacclimatised British soldier in the province in which it is stated to have its origin, while the civil population in his immediate vicinity may be almost decimated by the disease. The constantly recurring epidemics which, according to one view of the disease, issue forth from Lower Bengal and destroy the population, in the provinces beyond, in tens of thousands, have scarcely left their mark as stated on the unacclimatised British soldier: for in 20 years the European garrisons of Barrackpore, Dum-Dum, and Calcutta, have only returned 27 deaths from the disease. The fact is, there has been no epidemic visitation of cholera in the European garrisons of Lower Bengal during the past 15 years; and in no year of this period have the deaths exceeded four in any one station, while in the Upper Provinces and in the Punjab, epidemics have been much less severe and the mortality greatly less than in former times.

It may be of some importance to note that the immunity from cholera in recent years enjoyed by Fort William is likewise apparent in the similarly located, but otherwise very differently circumstanced, garrisons of Fort Agra and Fort Delhi; and the ratios of mortality from cholera, as tabulated, show in each case an enormous reduction in recent as compared with former years:—

	Ratio of Deaths from Cholera per 1,000 of Strength.			
	During 15 years from 1858 to 1872.	During 15 years from 1873 to 1887.	Actual Deaths.	
			1858–72.	1873–87.
Fort William	10·82	1·17	145	16
Agra (Fort)	14·62	1·40	227	21
Delhi (Fort)	8·71	1·02	100	7

Some authorities have attempted to prove that the immunity from cholera in Fort William, nowadays, is due solely to the improved water-supply; and even the German Sanitary Commission was led away by this belief, assuming on insufficient grounds

that the introduction of the Pulta water-supply, in November 1859, was the only explanation of the diminishing incidence of cholera in the European garrison of Calcutta. But the water in use at Agra and Delhi is obtained from relatively the same source as presumably it has been taken for ages; and the same marked diminution from cholera has resulted irrespective of the source and comparative purity or probable contamination of the water-supply.

Further, it is a remarkable fact that the Jessore jail, in the centre of the endemic area, during the 30 years from 1858 to 1887, recorded only 56 deaths from cholera, while the jail of Dehra Dun, far removed from the endemic area, returned a relatively much higher, actually over double the death-rate of the Jessore jail for the same period. The Gorakhpur jail, also situate beyond the endemic area, recorded nearly three times the ratio of mortality of the Jessore jail; and while the Gorakhpur jail had exemption from cholera, 14 years during the 30-year period, the Jessore jail showed no death from the disease in 19 years of the same period. The ratios of mortality in these jails are thus noted:—

Jails.	Ratio of Mortality per 1,000 of Population, from 1858–87.
Gorakhpur	12·03
Dehra Dun	8·71
Jessore	4·12

The immunity from cholera of the prisoners confined in the Jessore jail is in some measure comparable with the immunity of the troops garrisoning stations in the endemic area. This immunity is enjoyed by the troops and prisoners only, as the hamlets and villages in the vicinity of the Jessore jail, and in proximity to the stations in the endemic area occupied by European troops, are often decimated by the disease.

In disproof of a view opposed to the preventability of cholera, and the assertion that the disease is frequently returned under the less disagreeable name, it is a remarkable fact that in a hot climate like that of India only four deaths from diarrhœa were recorded in 1886, throughout the whole European army with an average strength of 61,015, and in 1887 only the same number of deaths from diarrhœa were recorded, while the average strength was 63,515. The inclusion, therefore, of the deaths from diarrhœa would not in the least appreciable degree affect the data furnished, as to the enormous decrease in the mortality from cholera among European troops in recent as compared with former years.

It is an indisputable fact that the incidence of the disease is greatly less in all more or less protected communities than it was, and that the average mortality from cholera was cent. per cent. more during the 15 years antecedent to 1873 than it has been during the more recent period. This enormous decrease in mortality among troops and prisoners is readily proved in whichever way the vital statistics be examined with reference to every section of the protected or partially protected communities. Again, where local sanitary protection is greatest, and palpable sanitary defects are fewest, there the improvement, as shown, is marked by the enormous total of 1,300 per cent. greater mortality in former as compared with later years. Such a demonstration of the preventability of a disease like cholera may serve to strengthen the hands of those to whom sanitary reform in India means the removal of sanitary blots stigmatised throughout the civilised world (*vide* German Sanitary Commission's Report, edited by Koch and Gaffky, Berlin, 1887, page 193 *et* sequel); and the mitigation of an ever-recurring pestilence which numbers its victims by tens and hundreds of thousands.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1887.

(*Surgeon-Major J. A. Laing.*)

Vital statistics.

The number of births registered in 1887, viz., 867,451 was higher than the number registered in 1886 by 12,417. The birth-rate (31·0) is the highest on record.

The following table shows the number of births and deaths registered in each year from 1869 :—

Table showing the Number of Births and Deaths registered for a series of Years.

Years.	Population for which returns were received.	Births.	Birth-ratio per 1,000.	Deaths.	Death-ratio per 1,000.
1869	24,633,127	452,410	18·5	451,981	18·3
1870	24,125,526	439,063	18·1	451,020	18·6
1871	24,555,046	517,109	21·0	444,371	18·0
1872	30,147,779	554,379	18·3	501,482	16·6
1873	30,287,842	538,123	17·7	506,894	16·4
1874	30,360,221	580,709	19·1	516,848	17·0
1875	30,278,903	638,771	21·1	641,260	21·1
1876	29,157,056	632,113	21·6	680,384	23·3
1877	29,209,542	477,447	16·3	1,556,312	53·2
1878	29,127,205	348,657	11·9	810,921	27·8
1879	28,991,267	477,762	16·4	549,390	18·9
1880	28,778,097	659,991	22·9	454,101	15·7
1881	28,676,375	731,866	25·5	465,682	16·2
1882	28,887,111	751,104	26·0	470,700	16·2
1883	28,503,100	791,774	27·7	541,930	19·0
1884	28,151,952	827,381	29·3	650,335	23·1
1885	28,118,178	824,042	29·3	615,449	21·8
1886	28,043,538	855,034	30·4	553,927	19·7
1887	27,907,840	867,451	31·0	604,775	21·6

It is satisfactory to find the steady improvement in the registration of births, which has been observed for several years past, continued in the year under report.

The total increase in the birth-rate for the Presidency was 6·0 per 1,000 of population above the mean of the preceding 10 years. In four districts only, viz., Ganjam, Vizagapatam, Godávari and Tinnevelly, the birth-rates were lower than those for 1886, but in all others a progressive improvement is observed when compared with the rates of the previous year. The districts of Kistna and Salem show the largest increase in 1887 over 1886 in the rate per 1,000 and Godávari and Vizagapatam the greatest decrease. The highest birth-rates registered were 42·5 in the Chingleput and 42·0 in the Kurnool districts. These two districts usually return the highest birth-rates, and is due to greater attention being paid to registration. Excluding the Nílgiris the birth-rate was lowest in the Godávari district (20·4); next to it Vizagapatam (20·6) and then Ganjam (21·4). These three districts have for some years always returned the lowest birth-rates, and the figures in the margin show that the birth-rates for Ganjam and Vizagapatam districts have been steadily decreasing year by year since 1884, and that registration of births was even more defective than in the previous year in these three districts.

—	Birth-rate per 1,000 per annum.			
	1884.	1885.	1886.	1887.
Ganjam	25·1	24·5	22·2	21·4
Vizagapatam	26·3	25·2	23·0	20·6
Godávari	20·6	21·0	23·7	20·4

In only four districts (excluding the Nílgiris) was the birth-rate above 40 per 1,000 (the assumed standard) of population, in nine it was over 30 and under 40 per 1,000, and in seven under 30 per 1,000.

Of the births registered, 443,847 were males and 423,604 females, giving a male birth-rate of 15·9, and a female one of 15·1 per 1,000. For every 100 females born there were therefore 104·7 male births, which is the average ratio between males and females for this Presidency.

As in the past year the births exceeded the deaths, and for 1887 it was at the rate of 9·4 per 1,000 of population. In all the districts, with the exception of Ganjam, there was an excess of births over deaths noticed. In Ganjam district the deaths exceeded the births at the rate of 2·9 per 1,000 of population, and was due, putting aside defective registration, to the great prevalence of fever.

The recorded birth-rates among the rural and urban populations were respectively 30·9 and 29·6, against 29·9 and 29·5 in 1886. In 11 districts (Bellary, Chingleput, Cuddapah, Kistna, Kurnool, North Arcot, Salem, South Arcot, Tanjore, Tinnevelly, and Trichinopoly) the birth-rates were higher in rural than in urban populations, the difference being most marked in South Arcot, Kistna and Chingleput districts. In the remaining nine districts the birth-rates were lower in the rural than in urban populations, the difference being most marked in the Coimbatore and South Canara districts.

There were 604,775 deaths registered during the year under report. In the previous year, 553,927 deaths, or 50,848 less than in 1887 were registered. The death-rate per 1,000 of population in 1887 was 21·6 against 19·7 in 1886, and 19·9, the average annual death-rate for the 5 years 1882–86. There were more deaths registered from cholera, small-pox, fevers, and "all other causes" in 1887 than in 1886, but fewer from bowel-complaints and injuries. Although the registered mortality was greater than that of 1886, yet it was lower than either that of 1885 or 1884.

Of the total deaths registered, 311,325 occurred among males, and 293,450 among females, the rate per 1,000 being 22·5 for males, and 20·7 for females. The registered male is thus higher than the registered female death-rate, and is in accordance with the experience of former years. The excess of male over female deaths registered during 1887 is most marked in the Ganjam district in which the male death-rate was 25·9, and the female death-rate 22·8 per 1,000 of population.

For every 100 females who died, 106 deaths among males were registered, but these proportions vary considerably in some districts.

In Nílgiri district	122·5	male deaths were recorded for every	100	female deaths.
In Malabar do.	115·9	do.	do.	do.
In Kistna do.	110·2	do.	do.	do.
In South Arcot do.	110·1	do.	do.	do.

Madras is the only district which has registered an excess of deaths among females over the deaths among males, and this is not in accordance with the experience of the Presidency as a whole. For every 100 females who died in Madras 97·8 deaths among males were registered.

There was as usual a very high mortality amongst infants under 1 year (22·9 per cent. on total deaths), and children above 1 year but under 5 (14·6 per cent.), in comparison with other periods of life. In fact the deaths in children under 5 years of age formed 37·5 per cent. of the total deaths, and this high rate of mortality among children is a sure indication of insanitation. The period when fewest deaths occurred was in the age of above 10 and under 15, the rate being 5·8 per 1,000 of population.

The death-rate fluctuates among the different classes of the population. For Native Christians it was 16·3 per 1,000, for Muhammadans it was 19·9, for Hindus 21·9, and for other classes 13·0. The death-rates are higher than those in 1886 for Native Christians, Muhammadans and Hindus, but lower "for other classes." For Muhammadans the maximum rate (44·2 per 1,000) took place in Madras, and the minimum (12·4) in South Arcot. In 1886 these results were 33·8 and 8·2, and occurred in Madras and Vizagapatam. Amongst Hindus the maximum rate (39·4) was in Madras and the minimum (15·2) in Nílgiris. In 1886 these results occurred in Madras (37·6), and Coimbatore (15·4). For Native Christians the maximum death-rate was 29·8, and took place in Madras, and the minimum (6·3) in Ganjam. In 1886 the results were 23·8 and 5·3, and occurred in the Nílgiris and North Arcot. In only 9 districts—Ganjam, Vizagapatam, South Arcot, Tanjore, Bellary, Anantapur, North Arcot, South Canara and Malabar—were deaths registered amongst "other classes."

As usual the greatest number of deaths (76,033) took place in December, and the fewest (41,510) in April. The marked increase in the number of deaths registered in December was due to cholera being very prevalent then in some districts, particularly Trichinopoly and Tanjore. The most unhealthy months were November, December

and January, that is, the months in which the greatest decrease of temperature takes place; and April, May and June, or the months in which the temperature again rises, are the most healthy. Almost invariably a sudden rise occurs in the death-rate in the month of December.

According to districts, the highest death-rate (39·4) is observed, as has been the case for some years past in Madras, then Kurnool (31·0), being 8·4 less than Madras. Twelve other districts recorded death-rates between 20 and 30, and 7 below 20 per 1,000. Those districts which recorded death-rates below 20 per 1,000 points to defective registration. The districts of Malabar and Nellore in which the registered death-rates were 15·8 and 17·6 per 1,000 respectively, are manifestly very incorrect.

By towns, the highest recorded death-rates are those of the towns of Berhampore and Anantapur, viz., 65·2 and 44·4 per 1,000 respectively, although the recorded death-rates of the districts of Ganjam and Anantapur and Bellary are only 23·0 and 27·5 respectively per 1,000. The lowest recorded death-rate (10·8) is that of the Municipality of Vániyambádi and the next lowest (14·0) that of Coonoor and Tirupatúr. These low death-rates show that registration of deaths is much neglected in these towns. Madras has a very high death-rate, viz., 39·4 per 1,000, or 3·3 higher than in 1886. There was an increase in the number of deaths from all causes in 1887 when compared with 1886. The death-rate for children under one year of age amounted to the excessive rate of 517·4 per 1,000, so that more than half the children who were born died before they were a year old. This high death-rate among children is not creditable to the leading municipality in the Presidency, and it may be said that the death-rate of children is in most places a far more reliable criterion of the sanitary conditions affecting the health of the communities than the total annual death-rate, even, although every allowance is made for neglect, deficiency of food, malnutrition and exposure. In 1886 the mortality among infants under one year of age in London was only 175·5 per 1,000.

Chief diseases.

The total mortality in the Presidency, classified according to the chief diseases during the year 1887, compared with previous years, is shown in the subjoined table:—

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1868	390,956	8,036	34,330	105,692	—	9,242	233,659
1869	451,981	21,034	17,448	132,346	—	9,310	271,843
1870	451,020	55,867	11,252	151,027	—	12,325	220,549
1871	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873	506,894	840	51,784	222,843	36,392	14,251	180,784
1874	516,848	313	48,343	226,220	37,993	13,065	190,914
1875	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876	680,384	148,193	23,469	230,092	38,176	11,175	229,279
1877	1,556,712	357,430	88,321	469,241	133,366	16,460	491,494
1878	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880	454,101	613	14,529	209,940	19,622	10,845	198,552
1881	465,682	9,446	15,776	203,542	18,961	11,527	206,430
1882	470,700	23,604	20,159	188,561	19,953	11,611	206,807
1883	541,930	36,284	37,975	203,786	22,098	11,509	230,278
1884	650,335	75,476	61,247	215,977	28,775	11,502	257,358
1885	615,449	58,109	34,726	218,786	31,209	11,659	260,960
1886	553,927	12,417	17,129	221,679	27,379	13,103	262,220
1887	604,775	28,359	21,472	240,860	26,679	11,328	276,077

Cholera.

During 1887 cholera caused 28,359 deaths throughout the Presidency equal to 1·01 per 1,000 of population, being 15,942 or 0·60 per 1,000 more than in the preceding year, but 29,750 less than in 1885. The total number of deaths from cholera in each of the 20 years ending 1887 is seen in the table above. The number of cholera deaths in 1887 was exceeded in eight out of the nineteen years quoted, and was 12,819 below the last quinquennial mean.

There was no month in the year when cholera was absent from the Madras Presidency. The greatest number of deaths was registered in December, in which month 13,626 deaths were reported as due to it.

From all the districts deaths from cholera were reported. In January only seven districts were affected, the disease prevailing chiefly in those districts situated on the East Coast north of Madras. In April and May the disease broke out in the Ceded Districts and gradually spread to other districts, and in December all the districts (with the exception of Kurnool) were affected. Taking the mortality by districts, the highest number of deaths (4,383), or 3·6 per 1,000 of population, took place in the Trichinopoly district. Next in order comes the Godávari district, where the number of deaths recorded was 3,676, or 2·0 per 1,000 of population, and following it the Tanjore district, where the deaths were 3,551, or 1·6 per 1,000. In the Cuddapah district, the deaths amounted to 3,361, or 2·9 per 1,000. In the Kistna and Coimbatore districts the deaths ranged between 2,000 and 3,000; in the Bellary, North Arcot, and Nellore districts between 1,000 and 2,000, whilst in the remaining 13 districts they were under 1,000.

Of the 28,359 deaths registered during the year, 14,615 were males and 13,744 females. The ratio per 1,000 of males was 1·0 and of females 0·9. The female deaths exceeded the male deaths in eight districts (Madras, Ganjam, South Arcot, Tanjore, Anantapur, Salem, South Canara, and Malabar), but in the remaining 14 the reverse is the case.

Of the 76 principal towns of the Presidency, 51 suffered from cholera during the year. In 10 towns the death-rate exceeded 5 per 1,000 of population, which is exceedingly high. Of the 54 municipal towns (excluding Madras) 43 were affected.

The measures taken by the district authorities to prevent the spread of the disease were generally satisfactory. Dr. W. G. King, District Medical and Sanitary Officer of Kurnool, reports:—

"Ample warning of the approach of the disease was given to all district officers by means of the new system of intercommunication between districts, and every effort was made, by inspection, and by working on an organised plan . . . . to ensure that villages were properly prepared for the campaign, and secondly, that instant reports as to the occurrence of cholera should be secured. In only one village did this system break down as a result of apathy or disobedience on the part of the village head. In this village the report of the existence of cholera was delayed, and time had been given for the wide sowing of the choleraic germ. Here 41 deaths occurred. Yet, although the disease was introduced to village after village, in no other case did it appear to get beyond reasonable chances of control. The total deaths throughout the whole district, including the municipality of Kurnool (45 deaths), amounted to 173 . . . As far as my experience during the several epidemics that have occurred during my service goes, I am of opinion that the spread of an epidemic of cholera is in inverse proportion to the amount of care that has been bestowed upon sanitary measures."

At Trichinopoly precautionary measures were taken by Surgeon-Major Nanney, who reports:—

"Cholera prevailed in the Madras Presidency during the year, and was noticed to be steadily travelling towards the south. District after district was attacked, and it became evident that the disease was rapidly marching towards us. Precautionary measures were at once adopted. Cholera first entered the district on the 11th October, and was imported into the town on 14th November 1887 by a constable who contracted it at Vathalay. It commenced in a sporadic form, but soon spread all over the town. The disease was most severely felt in localities where filth and overcrowding prevailed . . . . I made a careful analysis of the chief water-supply of the town, and found, with some exceptions, that it was exceedingly bad. I issued instructions for its protection from pollution by watchmen, and freely circulated printed instructions in English, Tamil, and Hindustani to be observed by the inhabitants on the probable advent during the commencement and outbreak of the disease. In fact, I left no stone unturned to impress upon the councillors the need of improved sanitation as a sure means of mitigating the evil, and to urge on the people the necessity of applying for early treatment in all cases of diarrhœa. I asked for special medical subordinates, and posted them to different parts of the town and district with a supply of medicines, brandy, Liebeg, turpentine, and printed instructions. Municipal vaccinators were relieved of their duties and instructed in the treatment of cholera; were directed to visit their respective divisions with this object. When the disease broke out I at once visited every portion of the town and suburbs and superintended the work of the sanitary staff. Sanitary inspectors were made to visit their respective divisions

constantly with a supply of disinfectants, and to see that cholera dejecta were properly disinfected."

The laws which govern the epidemic visitation of cholera are so imperfectly known that it would be useless to speculate as to why the disease increased in severity in 1887. We, however, know that for the permanent avoidance of epidemic disease, cleanliness is the sole safeguard, and that the chain of evil is abruptly broken wherever *thorough* cleanliness prevails.

The circumstances connected with the history, progress, and fatality of the disease in each of the affected districts cannot be given, as the district medical and sanitary officers do not furnish the Sanitary Commissioner with reports giving this information.

Small-pox.

During 1887 the deaths from small-pox of 10,777 males and 10,695 females, or a total of 21,472 (or 0·7 per 1,000) persons were recorded against 17,129 (or 0·6) in 1886 and a quinquennial mean of 34,247. Of the total deaths, 4,239, or 19·7 per cent., occurred among infants under 1 year of age, 8,619, or 40·1 per cent. among children over 1 but under 12, and 8,614, or 40·1 per cent., in persons above 12 years of age.

Small-pox was present in all the districts. The highest ratios (2·0 and 1·7) took place respectively in the Nílgiri and North Arcot districts. In the Bellary-Anantapur, Madura, and Ganjam districts the ratios per 1,000 of population were respectively 1·5, 1·4, and 1·2. The lowest ratios, 0·03, 0·04, and 0·09, took place respectively in Madras, Kistna, and Godávari districts. In districts the death-rate from small-pox was 0·7 against 0·5 during the previous year, and in towns 1·2 against 0·9 in 1886.

Of the 54 municipalities, in 42 there were deaths from small-pox registered. Ootacamund heads the list with a ratio of 7·7 per 1,000 of population, the rate for the district bring only 0·9.* Tellicherry in the Malabar district comes next with a ratio of 6·5, the district rate being 1·1.* The lowest ratio (0·03) per 1,000 of population took place in Vizianagram.

Fevers.

Fevers were, as usual, responsible for a large number of the deaths registered. The number of deaths attributed to fever was 240,860, or 8·6 per 1,000 (males 125,277, females 115,583). Compared with 1886 there was an increase of 19,181 deaths for the year under report. In all the districts, with the exception of Godávari, Kistna, Chingleput, Madura, Nílgiris, South Canara, and Malabar, fever caused a higher mortality during the year under review than in 1886. As most of the deaths are reported through curnams (men who as a rule are illiterate and have no spark of medical knowledge), they are inclined to ascribe, to "fever" all deaths which do not result from easily recognised causes. The maximum mortality from fevers took place in the month of December, when 25,433 deaths were reported, and the minimum in the month of June, when 16,675 deaths were recorded.

In 13 districts fever caused a higher mortality during the year under review than in 1886, in six a lower, and in two the mortality was the same. The highest death-rate (23·7) occurred in the Kurnool district, and the lowest (1·3) in the Tanjore district. For the past 13 years the highest death-rate from fevers has been reported from Kurnool district. In the district of Kurnool there is much canal irrigation, and the drainage being to a great extent defective, the subsoil is consequently water-logged in many places. In 15 districts the ratios of deaths were in excess of the mean rate for the previous five years, and in six less. The death-rates in 28 municipal towns were greater in 1887 than in 1886, in 24 less, and in two they were the same. The highest death-rate is reported from Berhampore, where it attained the enormously high rate of 43·2 per 1,000 of population against a district rate of 18·6. The lowest death-rate (0·6) was recorded by Masulipatam. The sanitary defects of Berhampore have been brought to the notice of Government, and unless steps are taken to provide some means as may drain away the large volumes of water which stagnate in and about the town, and which not only produce a wet subsoil, but, by absorption into the filthy subsoil of the town site, poisons the well waters, the prevalence of fever must be expected.

On comparing the death-rates from fevers in the districts and towns it is found that in only 14 municipal towns was the mortality greater than that of the districts. For the Presidency the death-rate from fever for municipalities was 6·3 per 1,000 of population (against 5·6 in the previous year), and among the rural population it

* Exclusive of the municipal towns.

amounted to 8·8 (against 8·0 in 1886). This fact points to the necessity for improving village sanitation. There is no doubt that much of the mortality attendant on fevers is due also to the habits of the people themselves, and it is to be feared that until their habits are materially changed, there will each year be a number of deaths from the various fevers which prevail at different seasons throughout the Presidency.

Bowel complaints.

During 1887 bowel complaints caused the deaths of 13,937 males and of 12,742 females, or a total of 26,679 against 27,379 deaths in 1886, the death-rate, 0·9 per 1,000, being the same in both years. There were fewer deaths in 1887 than in 1884, 1885, or 1886 from bowel complaints.

In seven districts the death-rates were lower in 1887 than in 1886, in three equal, and in 11 higher. Madras, as usual, heads the list with the very high death-rate of 7·3 per 1,000, or 0·8 more than in 1886. Following it comes Chingleput with a ratio of 4·0 per 1,000, and next to it South Canara (1·7). The Kistna district returned the lowest ratio, viz., 0·2, being 0·1 less than in 1886.

The district Presidency rate was 0·8 or 2·5 less than the municipal Presidency rate (3·3). In 45 municipal towns the death-rate was higher than in the districts, in seven it was lower, and in one equal. Among districts Madras heads the list with a ratio of 7·3 per 1,000, and next comes Chingleput with a ratio of 3·9. These two districts also obtained the highest death-rates, viz., 6·5 and 4·2 per 1,000 of population respectively in 1886. The lowest death-rate (0·2) was recorded in the South Arcot district. The highest death-rate in municipal towns from bowel complaints is reported to have occurred at Bimlipatam, where it attained the rate of 9·5 per 1,000, and next to it comes Tuticorin with a death-rate of 8·2 per 1,000, after which is Conjeeveram (7·4). The lowest death-rate (0·06) is recorded by Parlákimedi.

Injuries.

The deaths recorded from injuries amounted to 11,328 or 1,775 less than in 1886. Of the 11,328 deaths, 1,784 are registered as being due to suicide, 7,339 wounds and accidents, and 2,205 persons were killed by snakes and wild beasts. There was an increase in the number of deaths from suicide in 1887 when compared with 1886, but a decrease in all other kinds of injuries. As in last year, the greatest number of deaths caused by snakes and wild beasts occurred in the South Arcot district. The highest death-rate (0·6) from injuries was obtained by Madras, and, excluding Nílgiris, the lowest (0·2) by Ganjam and Vizagapatam.

All other causes.

There were 276,077 deaths returned under the head of "all other causes" in 1887, against 262,220 in 1886, so that for 1887 there is an increase of 13,857. The death-rate under this head was 9·8 per 1,000 against 9·3 in 1886.

Sanitary Works.

Municipalities.

The number of towns administered by the District Municipalities Act IV. of 1884 during 1887 was the same as that in 1886, viz., 54. I am glad to report that many municipal councils have now been induced to proceed, with regard to sanitary measures, in a more systematic manner than has hitherto been the case, and that they have decided, before incurring any further expenditure on drainage or water-supply, to have plans first prepared and approved. A difficulty has, however, been experienced in the preparation of these schemes, as the Public Works Department has been too short-handed to spare men to undertake this work in addition to its own. At present water-supply schemes are in preparation in Madura, Salem, Negapatam, Tanjore, &c., and drainage schemes in Negapatam and Kumbakónam.

Conservancy, by which is meant surface cleansing, seems to have been on the whole fairly well attended to during the year, but in some towns it is reported as having been either indifferent, defective, or unsatisfactory. Private scavengering, that is the management and control of privies in dwelling-houses by municipal agency, is now conducted in 36 towns. The importance of the system cannot be too much overrated.

The total estimated income of the 54 mofussil municipalities amounted to Rs. 19,61,310 during 1887-88 against Rs. 18,56,720 in 1886-87, being an increase in the revenue of Rs. 1,04,590, and indicating an incidence of Rs. 1-5-9 per head of

population against an incidence of Rs. 1-4-7 in the year before. It is to be regretted, however, that with an increased revenue the amount set aside for sanitary purposes fell short of that in the previous year by Rs. 27,902. The total sanitary allotment amounted to Rs. 6,20,571 against Rs. 6,48,473 in 1886–87, yielding a percentage of 31·6 on the estimated income against 34·9 in the preceding year. The allotment, though proportionally lower than that in 1886–87, may be accepted as a fair contribution of the revenues on the whole towards sanitation. In 27 of the towns (exactly one-half) the allotments made were more than those in 1886–87, and in the 27 others they were less. The largest increase was in Masulipatam (Rs. 9,622) and the smallest (Rs. 60) in Tellicherry. Though the allotment made by the Masulipatam municipality was great, yet it is to be regretted that the amount spent in the nine months ending with December 1887 was not in proportion to it; only Rs. 7,655 were spent out of Rs. 20,050, and it does not seem probable that the remaining sum of Rs. 12,395 could have been spent in the other three months of the year 1887–88. Of the total allotment, Rs. 3,86,862, or 62·3 per cent., were set apart for conservancy; Rs. 53,085, or 8·6 per cent., for improvement of town sites; Rs. 60,088, or 9·7 per cent., for improvement of water-supply; Rs. 4,490, or 0·7 per cent., for sanitary arrangements during fairs and festivals; Rs. 36,856, or 5·9 per cent., for the construction and repair of markets, slaughter-houses, &c.; and Rs. 79,190, or 12·8 per cent., for other sanitary objects. Conservancy had the largest share of the allotment.

The percentages of the sanitary allotments to income varied in the several towns from 10·0 in Calicut to 77·9 in Palni. Except in some few towns, as Calicut (10·0), Ongole (10·3), Vizagapatam (10·5), and Pálghat (11·8), where the allotments were below the minimum, generally speaking it may be said that the other municipalities contributed very fairly, and some of them very liberally, towards sanitation, such as Palni (77·9), Trichinopoly (53·7), Tanjore (52·4), Vellore (51·9), and Kumbakónam (48·0).

Of the total sanitary grant of Rs. 6,20,571 only Rs. 4,07,727 were expended during the nine months of the year ending with December 1887, leaving Rs. 2,12,844, or more than one-third, to be expended in the remaining three months of 1887–88. In 1886–87, the figures of which represent the transactions for the whole year, out of an allotment of Rs. 6,48,473, the expenditure amounted to only Rs. 5,25,377, thus allowing Rs. 1,23,096 to lapse unutilised. All the municipalities except two—Ellore and Salem, which had slightly exceeded the grant—failed to spend the full amount set apart for sanitation; but the greatest defaulters were Periyakulam, Vellore, Tanjore, Kumbakónam, Tinnevelly, and Trichinopoly, notably so Vellore, where nearly one-half of the sanitary grant was left untouched.

District local Sund boards.

The number of District Boards under Act V. of 1884 was the same as last year. No new works of importance were executed during the year. There was no change in the sources of water-supply, systems of drainage and conservancy, and the sanitary works accomplished and in progress at the close of the year were chiefly similar to those detailed in former reports. In the abstracts of the sanitary reports furnished to this office and statement appended are given the nature of the works and the amounts expended on them. Although they consisted of nothing of any magnitude, still what has been done shows that greater interest is being evinced generally by the authorities concerned in matters relating to sanitation, and the reports on the whole disclose progress year after year, though gradual. In some districts, however, the recommendations of district medical and sanitary officers do not receive that consideration which they deserve, notably so in Nellore. In Kurnool on the other hand the recommendations to remedy defects are taken up with earnestness by, and receive every attention from, the district authorities; much has been, and is under contemplation to be, done towards effecting sanitary improvements.

It is satisfactory to note an improvement in the number of places brought under conservancy management. Out of a total of 51,930 towns and villages in the Presidency, scavengering establishments were maintained, during the year under review, in 672 of them against 538 in the preceding year, being an increase of 134. An increase is observable in 11 out of the 21 districts and a decrease of 1 in each of the four districts—Ganjam, Chingleput, Bellary, and Nílgiris. In five others—Vizagapatam, Kistna, Trichinopoly, Tanjore, and Tinnevelly—the numbers were the same as in last year. The greatest advance made in this respect was in Cuddapah, where the number of towns and villages conserved rose from 48 in 1886–87 to 86 in 1887–88. In Madura 47 more towns and villages were conserved during 1887–88

than in 1886–87, in Salem 15, and in Malabar 13. Tinnevelly, which stood pre-eminent in 1886–87 in having conferred the benefits of a conservancy establishment on the largest number of towns and villages, gave way to Cuddapah in 1887–88, where the largest number (86) occurs. Tinnevelly stands second to it with 84; then comes Madura, where 78 towns and villages were conserved, followed by Godávari (63), Tanjore (39), Salem (37), Kistna (34), and Coimbatore and South Arcot (32 each). Of the four itinerating conservancy establishments maintained in Vizagapatam in 1886–87, three were abolished during the year under notice. This is much to be regretted, as the system of itinerating conservancy has many advantages. It is hoped, however, that the district board will see their way to re-employ the establishments dispensed with, and I would recommend that the system be adopted in other districts also as it is of much good in the way of surface cleansing and improvement of village sites. In only one district (Nellore) were there no conservancy establishments maintained in any of the villages. It is no matter of surprise then that the district medical and sanitary officer should report on its sanitary condition as follows:—

"As may be seen from all my sanitary reports the villages are remarkably dirty. The people answer the calls of nature where they please; pigs, buffaloes, cows, dogs, &c., being the only scavengers."

The total amount set apart for sanitation by all the District Boards amounted to Rs. 4,12,940 against Rs. 3,64,601 in 1886–87 or 31·2 per cent. of available income. The allotment taken as a whole appears to be reasonable, but in some few districts, as Malabar (6·2), Nellore (6·8), and Ganjam (13·7), the percentages are low. In the other districts the sanitary grants bear a very fair proportion to the available income, especially so in Coimbatore (51·7 per cent.), Salem (51·2), Kurnool (49·7), Bellary (49·6), Nílgiris (44·6), and Madura (40·1). In the remaining districts the percentages varied from 18·1 in South Canara to 39·0 in Anantapur. In Malabar, the circumstances and conditions of the district are such that it was not considered necessary to allot any large amount, but still it seems insufficient to meet all sanitary needs. In Nellore there could be no excuse, and the sanitary grant must be put down as having been quite inadequate. Considering the insanitary conditions that abound in this district, and which have been so repeatedly brought to notice by the sanitary inspecting officer, the district board should be prevailed upon to make larger assignments for the future and pay greater attention to sanitary matters.

Of the total amount (Rs. 4,12,940) sanctioned for sanitary purposes, the outlay for the nine months ending with December 1887 was Rs. 2,31,730, or 56 per cent. of it, leaving Rs. 1,81,210, or nearly 44 per cent., to be spent in the remaining three months of the year, an amount so much out of proportion to the period of expenditure, considered with the total allotment, that it leaves one to doubt if the whole of it could have been laid out during that time.

Taking the figures for the entire year 1886–87 as furnished by the several district boards in the sanitary reports, we find that out of a sanctioned allotment of Rs. 3,64,601 only Rs. 2,95,170, or 80·9 per cent., were spent during the year, thus Rs. 69,431, or 19·0 per cent., were allowed to lapse unexpended. This is very unsatisfactory.

General Remarks.

During the year I visited 23 municipal towns and the Deputy Sanitary Commissioner 17. In addition many small towns and villages were inspected. During my tours I pointed out to those councillors of municipal towns and village officers of small towns and villages, who in each place accompanied me in my tours of their towns, &c., any sanitary defects which I noticed, and the measures which should be taken to remedy them. There is no doubt that the degree of cleanliness of a place chiefly depends upon the amount of interest taken in it by the councillors or village officers. In certain municipalities the wards varied greatly as regards cleanliness, some being remarkably clean on account of the active interest taken in them by their councillors, while others were very foul from apathy of their councillors.

As regards smaller towns and villages, the influential men and village officers must be induced to take a permanent interest in sanitation, as it is to their action and co-operation that we must mainly look for sanitary improvements. To do this, however, is a difficulty which the sanitary officer has to contend against, as it is not

to be expected that the people will readily turn from insanitary habits of very ancient standing which the great body of the population regard as innocent. If Tahsildars, Deputy Tahsildars, &c., when on tour, took a real interest in the sanitary conditions of the places they visit, much good, I think, would result, and I would again suggest, as I did last year, that rewards should be given to those village officers who keep their towns and villages clean, and who are reported by inspecting officers as taking an interest in sanitation, and those village heads whose villages are reported as dirty should be censured. There can be no doubt that the success which has been achieved in vaccination in some districts has been due not so much to the willingness of the people to submit their children to the operation as to the active interest which has been taken, and useful aid rendered, by certain officers in the matter of vaccination. There seems, therefore, no reason to doubt that if the same interest was taken in sanitation by district officers that they would be equally helpful with regard to it.

In February 1887 I submitted to Government certain suggestions for improving the sanitary condition of towns and villages, and these suggestions were communicated to all presidents of district boards. I recommended that a beginning be first made with a single town or village in a taluk where the benefits derived from efficient sanitation could be practically shown to the people. In the town or village selected I suggested that the people should be given to understand that all rubbish must be taken to depôts beyond village limits, and not stored in compounds, that provision should be made for housing cattle in other places than in back yards and houses, and that some pieces of ground outside of the village should be set apart where people could resort for the purposes of nature. These measures can easily be carried out by the people themselves, and, if attention is paid to them, much good would result, as the streets and courts would be freed of the filth and refuse matters which encumber the surface, the atmosphere purified, and the wells protected from infiltration of sewage matter.

With regard to municipalities, &c., I addressed Government in March 1887 requesting that a ruling might be laid down whereby works of a sanitary nature may be carried out with some system and method. Government in G.O., No. 966 L., dated 30th May 1887, Local and Municipal, ordered that all plans of sanitary works estimated to cost Rs. 200 and upwards should, in future, be submitted to the Sanitary Commissioner through the district medical and sanitary officers. I have urged upon municipal councils the advisability of proceeding systematically with regard to sanitary measures, and not in a hap-hazard and piecemeal way, as has too frequently been the case. Many municipalities have now decided that before incurring any further expenditure on sanitary works (drainage, water supply, &c.), which have not hitherto been constructed on any regular and connected system, to have plans and estimates first prepared and approved, and then to execute the works in portions from time to time as funds become available. To aid municipalities in the preparation of designs for these schemes a difficulty has been experienced owing to the Public Works Department being too short-handed to undertake the work in addition to its own. The Trichinopoly municipal council, finding this difficulty, advertised for a sanitary engineer, and one having been obtained, arrangements are being made to have complete schemes of drainage, water-supply, &c., drawn up.

In some towns (Madura, Salem, Negapatam, and Tanjore), however, water-supply schemes are under preparation, and in Negapatam and Kumbakónam drainage schemes. The scheme for supplying Dindigul with drinking water from a well in the Sippanathu tank was not carried out, as the quality of the water was unfavourably reported on by the Chemical Analyst.

From the reports received there is evidence that sanitary improvements have taken place in some of the places visited, while in others no progress has been made, and all the filth remains untouched in and about the small towns or villages. The District Medical and Sanitary Officer, Kurnool, has taken great interest in trying to improve the sanitary condition of his district, and the district board of Kurnool have decided to attempt to deal with the sanitation of a single town (Nandyál) so as to embrace the questions of water-supply, conservancy, and drainage systematically and at one and the same time.

The advisability of instituting an examination for men who are desirous of becoming sanitary inspectors and overseers in order that their fitness for such posts might be ascertained, was brought before Government. At present no special qualification is required of men who are entertained as sanitary inspectors or overseers, and as con-

siderable powers are given to these men, it is evident that for the efficient and conscientious discharge of their duties that they should be acquainted with the fundamental principles of hygiene, and with the various sections pertaining to the Madras Local Boards Act and the Madras District Municipalities Act. Government did not think it advisable, on account of the low pay which sanitary inspectors receive at present, to prescribe any compulsory test. My letter was, however, circulated to presidents of district boards and chairmen of municipal councils, who were desired to insist on men already appointed taking pains to qualify themselves and to see that men whom they appoint in future possess the knowledge requisite for the proper performance of their duties.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1887.

(Deputy Surgeon-General T. G. Hewlett.)

Vital statistics.

In the Presidency of Bombay, including Sind, during the year 1887, the births of 327,500 males and 300,693 females, or a total of 628,193 children, were recorded against 303,376 boys and 278,177 girls, or a total of 581,553 children in 1886. They are thus 46,640 in excess of the number recorded in the previous year, whilst they exceed the mean of the preceding 10 years ending 1886 by 192,676.

The following table shows the number of births registered in each year from 1877 to 1887, their ratios per 1,000 of population, and the proportion of males to females :—

Years.	Population.	Number of Births Registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1877 - - -	16,181,741	164,262	147,399	311,661	10·15	9·11	19·26	52·75	47·25	89·73
1878 - - -	16,181,741	128,848	114,405	243,253	7·96	7·07	15·03	52·97	47·03	88·89
1879 - - -	16,228,774	151,460	136,410	287,870	9·33	8·41	17·74	52·61	47·39	90·06
1880 - - -	16,228,774	195,285	175,588	370,873	12·03	10·82	22·85	52·66	47·34	89·91
1881 - - -	16,454,414	239,912	219,745	459,657	14·58	13·35	27·93	52·19	47·81	91·59
1882 - - -	16,454,414	255,927	235,419	491,346	15·55	14·31	29·86	52·09	47·91	91·98
1883 - - -	16,454,414	261,966	239,835	501,801	15·92	14·58	30·50	52·20	47·80	91·55
1884 - - -	16,454,414	278,986	255,787	534,723	16·96	15·54	32·50	52·17	47·83	91·67
1885 - - -	16,454,414	298,406	274,025	572,431	18·14	16·65	34·79	52·13	47·87	91·83
1886 - - -	16,454,414	303,376	278,177	581,553	18·44	16·90	35·34	52·17	47·83	91·69
Mean for 10 years	16,354,751	227,843	207,674	435,517	13·93	12·70	26·63	52·32	47·68	91·15
1887 - - -	16,454,414	327,500	300,693	628,193	19·90	18·27	38·18	52·13	47·87	91·81

It is satisfactory to notice the progressive improvement which, except in the first three years of famine, has taken place throughout the Presidency in the registration of births. The increase in the years from 1885 to 1887 is to be largely ascribed to the progress which has been effected by the system of compiling the vital statistics in the offices of the Deputy Sanitary Commissioners, where the registers of births as well as those of deaths undergo very complete and searching scrutiny.

The number of births recorded in each district in 1887 was higher than in the previous year, except in the district of Eastern Gujarát in which it was lower. The increase in the Central and Southern districts was most remarkable, as the recorded births were 19,086 and 11,482 respectively in excess of those in the previous year, whilst they exceeded the mean of the preceding 10 years ending 1886 by 60,607 in the Central and 38,945 in Southern. The decrease in the district of Eastern Gujarát was not serious, as the recorded births in it were only 740 less in 1887 than in 1886. The total increase for the Presidency was 11·55 per 1,000 of population above the mean of the preceding 10 years. I have again to invite prominent attention to the extremely defective state of the registration of births in the city of Bombay which has been repeatedly commented upon, and I regret to find that no efficient measures have as yet been made to improve it, but of the 56 towns in the Presidency the city of Bombay occupies the fourth place from the bottom of the list. Government was pleased, last year, to direct the attention of the Municipal Commissioner to this matter; but no improvement has taken place. During the year, Dr. Blaney proposed that the registration should be entrusted to the Vaccination Department, and in reply to the Municipal Commissioner I stated I should have no objection

to this being done, provided that a sufficient establishment is granted to carry out the work, which, however, properly forms a part of the duties of the Health Officer.

The recorded birth-rates among the urban and rural populations of the Presidency were respectively 27·94 and 39·69, against 26·56 and 36·64 in 1886. Amongst the rural population of each collectorate, except Ratnágiri, Kánara, Ahmedabad, Karáchi, and Hyderabad, the birth-rates were higher than in the urban circles. In 1886 the birth-rates amongst the urban circles were also lower than in the rural circles in these collectorates.

Out of the 56 towns in the Presidency, 14 returned a birth-rate exceeding 40 per 1,000. The most remarkable improvement over last year is noticed in the town of Bijápur, in which a birth-rate of 52·70 was recorded against 26·26 in 1886. In many towns, however, the registration of births is still much neglected, and particularly, as noticed last year, in zilla stations, where one would have supposed the wishes of Government would have been more strictly attended to. For example, in the town of Thána, a birth-rate of only 8·65 per 1,000 was recorded against 6·09 in 1886, in the town of Sholápur, a birth-rate of 19·82 was registered against 20·86, and in the town of Kaira 25·87 against 30·30 in 1886. In the towns of Poona and Belgaum the recorded birth-rates were respectively 28·39 and 27·56 per 1,000 against 27·44 and 19·86 in 1886. Birth-rates, such as Thána 8·65, Kalyán 13·55, Balsár 15·49, Bombay 19·61, Chopda 19·81, and those returned by Sholápur, Násik, and Mahád are absolutely valueless. These and other municipalities, which have returned similarly inaccurate birth-rates, cannot be performing their duty properly, and I hope Government will be pleased to call the especial attention of the authorities to the necessity for much greater attention being paid to this most important subject. It is most disheartening to call attention to this subject year after year without any efficient steps being taken to improve registration. It seems to me if Government were pleased to inform these backward municipalities that it is prepared to quarter, at their expense, an establishment necessary to obtain a proper registration, that they would soon recognise the importance of the subject.

In 1887, among the civil population in the 285 rural, town, and cantonment circles in the Presidency of Bombay, the deaths of 238,358 males and 216,903 females, or a total of 455,261 persons, were recorded. In the previous year 381,185 deaths, or 74,076 less than in 1887, were registered. The following statement shows the number of deaths recorded in each year since 1877 :—

1877	-	627,708	1881	-	381,450	1885	-	473,591
1878	-	532,951	1882	-	343,418	1886	-	381,185
1879	-	387,542	1883	-	420,198	1887	-	455,261
1880	-	328,673	1884	-	408,409			

so that, as compared with the previous year, 1887 was an unhealthy year.

The computed death-rate per 1,000 of population in 1887 was 27·67 against 23·17 in 1886 and a decennial mean of 26·20. Omitting Sind, where the mortuary registration is still extremely defective, the recorded death-rate in the other parts of the Presidency amounted to 29·62 per 1,000 of population.

The millesimal ratio of males dying to males living was 28·05 and of females dying to females living 27·26. In 1886 these ratios were respectively 23·55 and 22·75. For every 100 females who died 109·89 deaths among males were registered, but these proportions vary considerably in some of the collectorates. As usual, the greatest discrepancy is to be found in Sind.

In 1887 the recorded death-rate per 1,000 of population was higher than in 1886 in each of the collectorates except Kánara, Karáchi, Hyderabad, Shikárpur, and Upper Sind Frontier. In the city of Bombay, Ratnágiri, and Dhárwár, the recorded death-rates are slightly in excess of those for 1886. In the city of Bombay it was 26·19 per 1,000 of population against 25·62 in 1886, in Ratnágiri 16·38 against 15·85, and in Dhárwár 28·12 against 27·25. In the collectorates of Thar and Párkar and Shikárpur, the recorded death-rates (16·66 and 16·47 per 1,000) are nearly the same as in 1886 (16·04 and 16·84 respectively). It was also higher than the annual mean of the preceding 10 years in 15 of the 24 collectorates. The exception being Bombay, Kolába, Ratnágiri, Belgaum, Dharwár, Bijápur, Kánara, Ahmedabad,

Karáchi. In Ahmedabád the death-rate (29·20) in 1887 was slightly lower than the mean (29·55),

In the city of Bombay the recorded birth-rate was much below the registered death-rate (19·61 and 26·19 per 1,000 respectively). The difference can only be ascribed to defective registration. In the collectorate of Broach the recorded birth-rate (38·37 per 1,000) in 1887 was slightly higher than the recorded death-rate (39·50). In all other collectorates the recorded birth-rates are considerably higher than the registered death-rates.

The mortality amongst infants under 1 year (21·88) and children above 1 year but under 5 (22·52) is, as usual, terribly high in comparison with other periods of life. In fact, the deaths among children under 5 years of age formed 44·40 per cent. of the total deaths. As repeatedly pointed out, the extremely high rate of mortality among children of tender years affords unmistakable proof of local causes of insanitation throughout the Presidency. The period of greatest immunity was in the age of above 10 and under 15, the rate being 6·43 per 1,000. For those above 60 and upwards the mortality was at the rate of 75·99 per 1,000. The percentage on total deaths amongst infants under 1 year is 21·88 against 24·20 in 1886. For those above 1 and under 5 the percentage on total deaths is 22·52 against 20·47 in 1886. For old people, 60 and upwards, the percentage on total deaths is 12·40 against 12·59 in 1886.

According to the census of 1881, the Mahomedan population numbered 3,107,171 persons, amongst whom, in 1887, 62,176 deaths were recorded against 58,625 in 1886, the death-rate per 1,000 being 20·01 against 18·87 in 1886. The Hindu population amounted to 13,128,587 persons, amongst whom 387,655 deaths or 29·53 per 1,000 of population were reported during 1887. In 1886 the total deaths amongst this race was 3,16,076, equal to a death-rate of 24·08 per 1,000. Amongst the Christian population, numbering 1,38,326 persons, 2,307 deaths were reported during the year against 2,301 in 1886, the death-rate being 16·68 against 16·63 per 1,000 in 1886. Under the heading "Other Castes" are included all those not belonging to either of the above sects, who, by the census of 1881, numbered 80,330 persons, amongst whom during 1887 there were 3,123 deaths against 4,183 in 1886, the death-rate being 38·88 per 1,000 against 52·07 in 1886.

Chief diseases.

The subjoined table shows the deaths, in 1887, arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1886 and the mean of the preceding 10 years. The causes of death will be briefly noticed in the next section:—

Causes of Deaths.	Mean for 10 Years, 1877–86.		1886.		1887.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera	22,543	1·38	167	0·01	25,711	1·56
Small-pox	6,747	0·41	876	0·05	3,753	0·23
Fevers	288,280	17·63	281,450	17·10	308,722	18·76
Bowel complaints	36,385	2·22	36,612	2·23	42,634	2·59
Injuries	6,296	0·39	5,692	0·35	5,558	0·34
Other causes	68,262	4·17	56,388	3·43	68,883	4·19
All causes	428,513	26·20	381,185	23·17	455,261	27·67

The recorded death-rates among the urban and rural population of the Presidency were respectively 18·33 and 29·05 against 25·80 and 22·79 in 1886.

Cholera.

During 1887, 13,576 males and 12,135 females, or a total of 25,711 persons, died from cholera, while in the preceding year only 167 deaths were recorded from this disease. In January the exciting cause of the disease, whatever that may be, was entirely quiescent throughout the Presidency, and not a single case occurred. In February 1 death was recorded in the city of Bombay, but in March there were 9 deaths in the Khándesh and 5 in the Násik Collectorates, whilst 2 deaths took place in Bombay. In April 159 deaths were recorded in 7 registration districts. In May the disease became

greatly intensified and spread to 10 Collectorates, causing 1,840 deaths. In June it assumed a still greater intensity and no less than 5,613 deaths were reported from 15 out of the 24 Collectorates in the Presidency. In July it attained its maximum degree of intensity and carried off as many as 6,882 persons. In August a fall took place, and only 5,123 deaths were reported, while in September the disease, although subsiding, prevailed more or less in 19 Collectorates and caused 2,762 deaths. In October and November a still further decline took place, and only 1,611 and 1,072 deaths were recorded. In December the disease abated considerably, but lingered in 15 Collectorates and caused 632 deaths.

The ravages of the disease were most severely felt in the Deccan, and principally in three of the five Collectorates comprising the Central Registration District. In Sátára the death-rate attained to the very high ratio of 6·55 per 1,000. In Sholápur also there was a very high death-rate—5·12 per 1,000, whilst in Ahmednagar, although it was not so intense, it still reached the high ratio of 3·93 per 1,000. The epidemic, although widely distributed, did not exhibit any very serious severity in other parts of the Presidency. In Sind its incidence was but slight, and was only fatal in the Shikárpur Collectorate where 201 deaths were reported. The remaining districts entirely escaped, except that one case was reported in Karáchi which, however, ended in recovery.

Out of the 24,535 villages in the Presidency, 2,461 or 10·03 per cent. were affected by cholera. The highest percentage took place in Sholápur Collectorate, where out of the 709 total villages 282 or 39·77 per cent. were affected. In Sátára out of 1,340 total villages, the disease appeared in 441 or 32·91 per cent. In the Ahmednagar, Bijápur, and Poona Collectorates the percentages were respectively 26·67, 23·44, and 21·68; and in Khándesh, Surat, and Broach, they were 12·02, 11·40, and 10·92; whilst in the remaining 12 Collectorates they were below 6.

Small-pox.

During 1887 the deaths from small-pox of 1,945 males and 1,808 females, or a total of 3,753 persons, were recorded against 876 in 1886 and a decennial mean of 6,747. The disease was principally confined to the Western Registration District, where it attained a ratio of 0·77 per 1,000 against 0·09 in 1886 and a decennial mean of 0·59. In Sind Registration District the ratio was 0·08 against 0·10 in the previous year, and 0·22 the decennial mean. In the Eastern Gujarát Registration District it was 0·07 against 0·02 in the previous year, and a decennial mean of 0·31. In the Central Registration District and the Southern Registration District the ratios per 1,000 of population were respectively 0·04 and 0·02 against 0·01 and 0·06, and the decennial mean of 0·33 and 0·56. In the Collectorates, the highest ratios—2·16, 0·28, 0·19, and 0·18—took place respectively in Khándesh, Násik, Surat, and Shikárpur Collectorates, and in two Collectorates, viz., Bijápur and Ahmedabad, there was a ratio of 0·01 per 1,000 in each. Only 2 deaths from this disease were recorded in the Sholápur, Belgaum, Kánara, and Karáchi Collectorates respectively, while in Sátára, Kaira, and Upper Sind Frontier not a single death occurred.

According to age, 29·48 per cent. of the deaths occurred among infants under 1 year of age, whilst 60·96 per cent. took place among children over 1 and under 12, the remaining 9·56 per cent. being among persons over that age.

Fever.

During 1887, 160,726 males and 147,996 females, or a total of 308,722 persons, were reported to have died from fever against 281,450 in 1886. The increase, therefore, for the year under report as compared with 1886 amounted to 27,272 deaths, whilst the mean for the previous 10 years is 288,280.

In the Eastern Gujarát Registration District fever caused a higher mortality (25·13 per 1,000) during the year than in 1886 (21·21) and the decennial mean (22·82). In the Western Registration District the death-rate was 19·35 against 17·35 in the previous year, and the decennial mean 17·21. In the Central Registration District the ratio was 18·60 against 16·64 in 1886, and 16·80 the decennial mean. In the Southern Registration District the ratio was 0·83 higher than 1886, but 3·33 less than the decennial mean. In Sind Registration District the rate for the year (14·43) was less than in 1886 (15·63) but higher than the decennial mean (12·29).

By Collectorates, excepting in Bombay, Ratnágiri, Dhárwár, Kánara, Karáchi, Hyderabad, Shikárpur, and Upper Sind Frontier, there was an increase in the ratios during the year over 1886. The Collectorate of Broach heads the list with a very high ratio of 33·39 against 26·08 in 1886 and 27·04 in the previous 10 years, and in the following Collectorates high rates are observed: Panch Mahál 27·12, Khándesh 26·34,

Kaira 25·52, Ahmedabad 23·58, Sholápur 22·83, Násik 22·60, Ahmednagar 22·35, Sátára 21·68, and Surat 21·58; the Presidency rate being 18·76 against 17·10 in the previous year and 17·63 the decennial mean.

Bowel complaints.

During 1887, bowel complaints caused the deaths of 23,363 males and of 19,271 females, or a total of 42,634 persons against 36,612 in 1886, and a decennial mean of 36,385.

The Southern Registration District heads the list with a high ratio of 4·95 against 4·06 in 1886 and 3·80, the decennial mean. The Western Registration District comes next with a ratio of 3·13, and next to it is the Central Registration District 2·49, the Eastern Gujarát Registration District 1·67, and Sind with a rate 0·22. In this Presidency the rate was 2·59 against 2·23 in the previous year and a decennial mean of 2·22. In 16 Collectorates the death-rate was higher, and in 8 it was lower than in 1886. The highest ratios were recorded in Belgaum 6·73, Dhárwár 5·86, and Khándesh 5·34, and the lowest in Hyderabad 0·12, and Thar and Párkar 0·06.

Injuries.

During 1887, 3,255 males and 2,303 females, or a total of 5,558 persons, met with violent deaths. The mortality from these causes is less by 134 than that reported in 1886, when 5,692 deaths were recorded. Of these 5,558 deaths, 2,245 were caused by drowning, 1,164 resulted from snake bites, 470 from wounds, 241 from hanging, 162 by poisoning, 84 from attacks by wild beasts, and 1,192 from causes not specified.

Other causes.

The recorded deaths from causes other than those specified numbered 68,883, 35,493 of which occurred among males and 33,390 among females. The total for 1886 was 56,388, so for this year there is an increase of 12,495.

Vaccination.

The following table contrasts the work amongst the Civil and Military population during the year under report with that for 1886–87 :—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1886–87.	1887–88.	Increase.	Decrease.	1886–87.	1887–88.	Increase.	Decrease.	1886–87.	1887–88.	Increase.	Decrease.
IN CIVIL LIFE.												
Itinerant	834,986	867,736	32,750 3·92	—	44,972	47,205	2,233 4·97	—	879,958	914,941	34,983 3·97	—
Dispensary	17,699	8,501	—	9,198 51·97	943	734	—	209 22·16	18,642	9,235	—	9,407 50·46
Total	852,685	876,237	23,552 2·76	—	45,915	47,939	2,024 4·41	—	898,600	924,176	25,576 2·84	—
IN ARMY LIFE.												
Native Army	2,970	3,117	147 4·95	—	1,618	1,352	—	266 16·44	4,588	4,469	—	119 2·60
British Army	317	401	84 26·49	—	405	499	94 23·28	—	722	900	178 24·65	—
Total	3,287	3,518	231 7·03	—	2,023	1,851	—	172 8·50	5,310	5,369	59 1·11	—
Total for the whole Presidency.	855,972	879,755	23,783 2·78	—	47,938	49,790	1,852 3·87	—	903,910	929,545	25,635 2·84	—

The number of persons primarily vaccinated was 879,755, and 49,790 were re-vaccinated against 855,972 and 47,938 in 1886–87, showing a net increase of 23,783 or 2·78 per cent. under primary vaccinations and 1,852 or 3·87 under re-vaccinations. The rate of decrease in primary and re-vaccinations in dispensaries was 51·97 per cent. in the former, and 22·16 per cent. in the latter. The greatest decrease (50·46 per cent.) under total operations was also amongst dispensaries. This decrease was due to the transfer of the vaccination work from the medical officers in charge of dispensaries to the táluka vaccinators under the orders of the Government of Bombay in their Resolution No. 3,851, dated 1st November 1886. On the whole there has been an increase of 25,635; or, in other words, for every 100 persons operated on in 1886–87 the numbers for this year have been 102·83.

The following table shows for the last two years the number of infants successfully vaccinated in the Presidency, *exclusive of Native States*. The birth and death statistics are taken for the calendar year in calculating the number available for vaccination, because infants are generally not vaccinated until three months after birth :—

Years.	Children Vaccinated successfully.		Children available for Vaccination.	Births returned as having been registered.	Deaths registered among Children under 1 year.
	Those under 1 year.	Those between 1 and 6 years.			
1886–87 - - - -	361,720	149,190	489,302	581,553	92,251
1887–88 - - - -	376,791	144,687	528,556	628,193	99,637

This year also the successful vaccinations fell short of the registered births *minus* deaths amongst those under one year old. Out of 528,556 infants available for vaccination 376,791 or 71·29 per cent. have been protected. Last year the percentage was 73·93.

Out of 879,755 persons primarily vaccinated 839,263 were successful or 95·40 per cent., being only 0·09 less than in 1886–87. The number of unsuccessful cases was less than that in the preceding year, being 15,511 against 15,703. 1,487 persons were operated on a second time on account of the failure of the first operation, and in 26,468, or in 1,713 cases more than in the year 1886–87, the result was unknown.

During the year 49,790 persons were re-vaccinated against 47,938 for 1886–87. In 96 instances the re-vaccinations were repeated; in 7,436 instances the results could not be ascertained, and in 10,007 the operations failed. The number of successful cases was 32,443 or 65·16 per cent. against 64·55 in the preceding year.

The total number of persons operated on was 929,545, and of these, 871,706 or 93·78 per cent. were successful. In 1886–87 the percentage was 93·85. 1,583 persons were operated more than once; the "unsuccessful" numbered 25,518 and the "unknown" cases were 33,904.

The ratio to the total population of protection by successful primary operations is higher than last year in all the districts and circles except Eastern Gujarát, Western Gujarát, and Sind Registration Districts. It is lowest in the Presidency Circle, being 22·97 per 1,000. In British and Native Territory it is respectively 31·87 and 32·97 against 31·65 and 32·39 per 1,000 of population in the previous year. On the whole 32·37 persons of all ages per 1,000 of population against 31·91 last year, 31·94 in 1885–86, 29·84 in 1884–85, 30·89 in 1883–84, and 29·74 in 1882–83, were primarily vaccinated successfully.

The age details are compiled for three periods, viz., under one year, between one and six, and above six years. The numbers under each period primarily vaccinated were respectively 611,361, 254,690, and 13,704 against 585,745, 258,205, and 12,022 during the preceding year.

The quality of the lymph in use throughout the year was good. There was only one consignment of English lymph of 45 tubes for the Bombay district and one of six tubes for Aden during the year.

Animal vaccination was carried on in Bombay, Poona City and Cantonment, and Rájkot. The operation of inoculating heifers was generally successful. In Western Gujarát animal vaccination was, in the commencement of the cold weather, as usual, carried on in Rájkot by inoculating eight out of nine heifers successfully, and the lymph was distributed among the vaccinators. Except in Bombay, where animal lymph only is used, and in Poona and Rájkot, where both animal and human lymphs were in use, vaccination in all other places was carried on from arm to arm and with human lymph. Vaccination with animal lymph was also carried on in Bándra.

Taking together the work of all the Deputy Sanitary Commissioners, Superintendents of Vaccination, Assistant Superintendents of Vaccination, and Inspectors of Sanitation and Vaccination, there were 4,531 encampments, 81,798¼ miles travelled in, 8,423 days, and 313,860 children inspected in 13,628 villages. Out of every 100 persons operated on 33·96 were this year inspected against 35·75 in the preceding year.

Inoculation was not reported to have been practised anywhere in the districts, and no instances were reported of any disease having been communicated through vaccination.

In Bombay the Compulsory Vaccination Act has been in force for 10 years and in Karáchi for 8 years, and in both places there has been, since the introduction of the Act, a considerable increase in the number of infants protected.

Sanitary Works.

Military works.

The actual outlay on military works amounted to Rs. 4,02,686 during the year 1887. Of this sum Rs. 3,19,493 were spent in Bombay and Colába, of which Rs. 677 were for constructing temporary latrines and urinals for the General Post Office, Rs. 2,020 for drainage of the Elphinstone College, Rs. 1,385 for constructing a masonry drain in the compound of the European General Hospital, and Rs. 13,944 on drainage of the Officers' bungalows in the Marine Lines. At several other stations large sums were spent on work more or less connected with sanitation. At Devláli Rs. 13,906 were spent on military works. At Baroda Rs. 11,820 were expended on constructing new drains in the Sadar Bazár and improving the Cantonment drainage. At Ahmedabad Rs. 13,247 were expended. At Poona Rs. 3,423 were expended: of this sum Rs. 2,769 were for carrying out a portion of the drainage scheme in the Native Cavalry Lines at Ghorpuri. At Karáchi Rs. 3,708 were expended: of this sum Rs. 1,850 were spent for providing extra latrine accommodation to the Station Hospital. In the Aden District Rs. 10,212 were spent on several works of improvements, additions, and alterations during the year.

Civil works.

The total annual income of the Municipalities during the year 1886–87 was Rs. 34,79,558, and the sum expended on conservancy by them was Rs. 7,36,449.

The population, annual income, and expenditure on conservancy in each Revenue Division will be found in the following table:—

Division.	Population.	Income.	Expenditure on Conservancy.	Division.	Population.	Income.	Expenditure on Conservancy.
		Rs.	Rs.			Rs.	Rs.
Northern Division	574,465	9,89,689	2,63,065	Southern Division	344,372	4,23,511	1,09,191
Central Division -	652,997	11,91,030	2,18,300	Sind Division -	319,571	8,75,328	1,45,893
				Grand Total	1,891,405	34,79,558	7,36,449

Water-supply, which is ample and of fairly good quality, is derived from rivers, tanks, and wells. Some of the municipal towns are mainly dependent on rivers for their drinking water-supply; and during the hot season, when the water becomes scanty, peons are temporarily employed to see that the water is not fouled, and when the rivers cease to flow, temporary wells are sunk in their beds. In Sind canal water is used for drinking purposes in several towns.

Drainage.—In some municipal towns there are open masonry side drains in the main streets, in others there are mere earth trenches, in some there are cuttings, and in some, owing to the towns being situated on an elevated ground, there are natural drains to carry off rain water. In some municipal towns there is a great want of drains, but owing to the insufficiency of funds the municipalities are unable to undertake these works.

Cesspools.—There are but few municipal cesspools, but in nearly all towns most of the private houses have them, and the owners at intervals see to their cleanliness at their own expense. 1,587 feet of new gutters have been constructed by the Jalgaon Municipality during the year. In Karáchi about 25 new cesspools have been constructed after the standard plan adopted by the municipality. Their conservancy receives careful attention. The total number of cesspools is about 825. The Sukkar Municipality has constructed one new cesspool during the year.

Scavengering.—The usual staff of sweepers is entertained by each municipality to keep the town and streets clean. Dustbins are provided in most towns in convenient spots, and emptied daily. Other arrangements same as last year.

Latrines.—The larger number of municipal towns have public latrines, and privies in some towns are cleaned by municipal sweepers. Night-soil from latrines is carted to depôts about a mile or two from the towns, and is either buried or converted into poudrette.

Personal Proceedings and General Remarks.

In the last annual report the details were given of my tour in the commencement of 1887. On my return to Bombay I proceeded to Poona, where I stayed during the hot weather, as I was anxious to continue my observations regarding the water-logged condition of the land below the canal during the hottest months of the year. I, however, visited Ahmednagar during this season. I stayed the rains at Poona, visiting Broach in July on urgent business. The greater part of November was passed in Bombay. I then proceeded to Surat, Broach, Nadiád, and Ahmedabad, and returned to Bombay by the close of the year, and then visited Sátára, Belgaum, Dhárwár, Hubli, Gadag, and Bijápur, returning to Bombay by the commencement of March.

At all the above towns, with the exception of Gadag, I met the municipal commissioners and tried to arrange with them for provision being made in their annual budgets for water-supply, surface drainage and conservancy, but with little success. At Gadag, although I attended the municipal office by appointment, only six municipal commissioners put in an appearance. I was therefore unable to address them on these subjects.

The health officer of the port has submitted a very interesting report giving full details of the work performed by him during the year, but I can only briefly allude to the more important points connected with it as it is impossible in a short review to do justice to all the subjects touched upon.

By Government Resolution, Revenue Department, No. 8472, dated 12th December 1887, it was ruled that in case of vessels conveying a large number of cattle to Mussowah for the Italian Expeditionary Force, the cattle should, before being embarked, be examined by a qualified veterinary surgeon. This order is, from a sanitary point of view, most necessary, and the Health Officer has recommended that a similar order should be passed regarding vessels bringing cattle, horses, &c., to Bombay. The necessity for this was recently brought strongly to notice by a vessel arriving from the Persian Gulf with a cargo of horses among which glanders had appeared.

During the year 440 square-rigged vessels and steamers conveying 35,075 persons, and 255 native craft with 5,953 persons on board, and 18 pilgrim ships carrying 11,096 souls, or a total of 713 vessels and 52,124 persons, left the port after inspection by the Health Officer, against 781 vessels and 54,318 persons in 1886. Clean bills of health were given in every case.

It is satisfactory to notice that Dr. MacCartie reports that much greater attention has been paid to the cleanliness of ship's bilges, and that no death occurred during the year on board ship from mephitic poisoning.

Clean bills of health were granted to 19 troop-ships leaving the port during the year without an inspection by the Health Officer of the port of their crews and passengers, on production of certificates stating that the vessels were in a satisfactory sanitary condition, and that there was no case of infectious disease dangerous to life on board.

Clean bills of health were also issued to 398 vessels bound to ports round the Coast, Rangoon, Singapur, Hongkong, &c.

During the year quarantine was imposed at Suez against Bombay for 66 days, although only 262 deaths from cholera took place in the city of Bombay during it, and the disease was at no time declared by the medical board to exist in an epidemic form.

During 1887, 810 steamers and square-rigged vessels carrying 16,209 passengers and 352 native sailing vessels with 2,200 passengers on board entered the port from ports other than Indian ports, and 1,060 steamers and square-rigged vessels, and 56,102 native sailing craft arrived in the harbour from Indian ports. All vessels entering the port have had free pratique, except in the case of three steamers which on arrival had the yellow flag flying on account of cases of small-pox having occurred during the voyage. All Her Majesty's troop-ships (11 in number) were, as usual, inspected by the Health Officer on arrival.

Ten vessels with pilgrims on board arrived in the port during the year. In those in which there had been cases of small-pox, the persons who were unprotected were vaccinated before being allowed to land. These vessels conveyed 5,726 pilgrims, among whom there were on the return voyage 494 [redacted] admitted into hospital. (In one vessel carrying 703 pilgrims, no information is given as to the number of

admissions.) In three vessels conveying 614 pilgrims there were no deaths, and among the remainder 64 deaths occurred.

Cholera broke out among the harbour population in July and lasted until November. In all there were 30 cases, 24 or 80 per cent. of which proved fatal. This great fatality of cholera among the harbour population has often before been noticed, but I regret that no measures have as yet been taken to provide for their treatment by having a hospital ship in the harbour.

Dr. MacCartie again forcibly comments upon the very foul and insanitary condition of the foreshore of the harbour which, though an improvement is noticed in some of the bandars, is still in a most dangerous state.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1887-88.

(*Sir H. L. Harrison, Chairman.*)

Calcutta in 1876 and 1888.

As 1888 is the last year of Calcutta under the Act of 1876, it seems fitting that before the change of system comes into effect, a comparison should be instituted between Calcutta as it was in the last year under the old *régime*, and Calcutta as it is in the last year of the *régime* of the Town Commissioners. Such a comparison is the more instructive because, unlike most cities, the boundaries and the population of Calcutta have during that period remained stationary. For well-known reasons which have been often stated, it was found at the Census of 1881 that the population of Calcutta had tended to decrease rather than to increase, and as those reasons have remained in full operation since 1881, there are no good grounds for supposing that any alteration has taken place in this respect since the Census. Hence, whatever progress may be brought out by the comparison is, in the case of Calcutta, real progress, increased comforts, increased wealth, and improved conditions of life to a population unchanged in numbers.

It is obvious that if the population of a large city has increased by 20 per cent. in the last decade, it is nothing to show that it is 20 per cent. richer, as evidenced by the productiveness of its taxation, or that 20 per cent. more water is supplied to it. Or, again, if the municipal area has increased by 20 per cent., it would be no real progress to show 20 per cent. more roads, 20 per cent. more gas lights, and 20 per cent. more sewers, but when the municipal area is unchanged and the population has not increased, an increase all round in wealth, in the comforts and appliances of civilisation and in sanitary requirements, is an irrefragable evidence of improvement.

Taking the oldest of the great improvements of Calcutta first, the drainage system which was commenced before the time of the Justices, the record stands thus—

	(Dec.) 1876.	(April) 1888.
Brick sewers in miles - -	39·21	42·57
Pipe sewers in miles - -	47·34	144·50
Total - - -	86·55	187·07

The amount spent upon the drainage up to the end of 1876 is shown by the auditors as Rs. 69,10,972, while the expenditure up to the end of the official year 1887-88 is similarly shown as Rs. 1,03,11,600, of which, however, a sum of Rs. 6,13,876 was contributed by Government, being half the cost of the Storm Water Drainage Works, necessitated by the closing of the Chitpore canal as an outlet. Deducting this, the municipal money sunk in drainage works was Rs. 96,97,724. The Act of 1876 compelled the commissioners to spend 1½ lacs annually towards the completion of the drainage; it will be seen that in 11 years they have spent Rs. 27,86,752, or over 2½ lacs per annum. Even if the special works, connected with the Storm Water Drainage, which were not contemplated when the Act was passed, be omitted, the expenditure on the completion of the ordinary drainage of the town has only just fallen short of an average of 2 lacs a year. Taking one year with another, therefore, the Commissioners have fully complied with the requirements of the law.

Briefly it may be said that when the Commissioners took over the town, the arterial sewers were completed and about one-third of the pipe-sewers laid. They have completed the sewerage of the town, and have also constructed a new system of

channels which convey the storm overflow water to the lakes, instead of into the Chitpore canals. Sewer adjuncts too have been greatly improved; 125 flushing wells and 102 flushing chambers have been constructed at pipe sewer-summits, to improve the flushing of the pipe sewers, which was not provided for in the general scheme; 1,420 cast-iron manhole covers have been put down in the streets, obviating the necessity of digging up and replacing a square yard of roadway every time a manhole is opened to cleanse a sewer. This is a very great practical improvement.

The result of this extension of the drainage system is that nearly all the premises in the town are now connected with the sewers. There were in the town at the end of the year 1887–88, 23,055 premises occupied by pucca houses, and 3,715 premises of bustee land or unoccupied land. On these bustee lands there were 18,655 tiled huts; and as each of these are separately numbered, the aggregate of premises, houses, lands, and tiled huts combined amounted to 45,425; but as the tiled huts stand on the bustee lands, the number of premises for drainage purposes is only 26,776. Out of these the actual number connected on the 31st March 1888 was 23,849. The number similarly connected up to the end of 1876 was 7,214 only.

The surface improvement resulting from the obliteration of the elongated cesspools which were called drains, can only be sufficiently appreciated by those who were familiar with the former state of things, but the general extension of the underground sewers has brought with it a new and special danger of its own. Sewers to work well and innocuously must not only be constructed with care and attention to rules, but must also be constantly watched and kept in order. It is here that difficulty has been experienced. The construction of connexions has necessarily been entrusted to a large number of contractors whose pecuniary interest it would be to scamp the work, while even, if constructed properly in the first instance, many owners do not realise the importance of unremitting attention to their due maintenance. Hence the Commissioners found it necessary in 1882 to entertain a special inspecting staff, to examine the drainage arrangements of each house and point out defects. The number of premises inspected by these officers in each year is over 5,000, and thus far the proportion of defects discovered is about one in every seven premises inspected.

In one respect no progress worth speaking of has been made: that is, in ventilating the sewers by shafts or pipes. Though the law allows this to be done, the sewers are still, as in 1876, ventilated at ground level, and when there is a heavy down-pour of rain, and the sewers get filled with water, the sewer gas is forced out into the roads, and is very perceptibly offensive. The reason for absence of progress in this respect is that doubts are still entertained whether there is any valid sanitary objection to ventilating sewers into the centre of broad streets. The evidence at present before the Commissioners on this point is conflicting.

The average quantity of filtered water supplied to the town *per diem* in 1876 is shown in the official record as 6,541,154 gallons. The total number of houses connected was 9,675, and the expenditure on the works was shown by the auditors as Rs. 71,56,986. The unfiltered supply was 721,675 gallons per diem. In the report for 1876, the question of increasing this supply is referred to in the following guarded terms:—

"The sense of the present corporation is that if the charge for interest on the necessary capital to be borrowed can be found without increasing the burden of taxation, the Commissioners will cordially support the extension."

And—

"If there was a larger supply of unfiltered water, the filtered water now used for flushing latrines and watering roads might be saved, and a large saving effected in the cost of watering streets by carts. The matter of extending the supply is already before the Commissioners, but there is at present a strong feeling against any increase of house assessment to meet charges for interest for further loans, and the whole problem of the extension of the water-supply can only be solved if the Government will allow the amalgamation of the various funds and the repayment of the loan by half-yearly instalments with a proportionate decrease of interest. The saving in interest thus effected being applied to the payment of interest on the new extension loan."

These deliverances were not very promising for the extension works, and as a fact it was not till 1883 that the work of doubling the supply was seriously pushed on. The Government granted the concession asked for as regards the waterworks debt already incurred. The loans were amalgamated, and only $4\frac{1}{4}$ per cent. charged on the consolidated loan, while the rate of repayment was reduced from 2 per cent. to 1 per

cent.; but these advantages were for a long time more than counterbalanced by the injurious effect of the Government decision to lend no more money to local bodies, but to compel them to borrow in the open market. In 1884 and 1885 borrowing in the open market was so difficult that the progress of the extension works was most seriously impeded by want of funds. But money at last became easier, and the Commissioners have now carried out a most comprehensive scheme of extension, which not only increases the supply of filtered water to the town from the original supply of 6,000,000 gallons a day to 16,000,000 gallons, but also provides an additional 4,000,000 gallons for the suburbs. It was found, however, that owing to the increasing drain upon the water, it would be impossible to deliver a proper supply to the parts of the town situated near the river bank without the assistance of a new pumping station. This project has therefore been sanctioned, and is also approaching completion.

In addition to the extension of the filtered water supply, the unfiltered supply has likewise been improved, and is now in a most satisfactory condition. Unfiltered water has replaced filtered water entirely for watering the streets and for flushing latrines and sewers, and it also supplies with water nearly 100 bathing platforms. With all this an excellent pressure is kept up in the unfiltered water pipes throughout the town. The daily supply given in 1887–88 was 2,501,830 gallons. The capital sunk in the water-works, filtered and unfiltered, up to the end of March 1888, was shown by the auditors as Rs. 1,22,86,485. The number of houses connected with the water-supply is 17,580. The full amount of 16,000,000 gallons per diem cannot be delivered till the new engines now being erected at Tallah are in their place. The actual average delivery of water in 1887–88 was 10,326,601 gallons. By the time the new law comes into force, the filtered supply to the town will be 150 per cent. better than in 1876, and the unfiltered supply 300 per cent. better.

The length of roads in Calcutta in 1876 was 132 miles, on 31st March 1888 147 miles, besides 34½ miles of public paths over sewered ditches. The total area of the roads exclusive of the sewered ditches is 16,173,033 superficial feet, of which 11,757,874 superficial feet, or 72½ per cent. of the whole, is watered entirely with unfiltered water. In 1876 the superficial area of the streets was 14,620,108 feet, out of which 8,835,042 superficial feet were watered, 5,432,143 with unfiltered, and 3,402,899 with filtered water. Thus, besides turning into useful footpaths most of the old open drains of the town, the roadway has been augmented by about 10 per cent., and the area watered by 33 per cent. As the area of the town has remained unchanged, this shows considerable progress.

The lighting of the town has done more than keep pace with the increased roadway. The comparative figures are :—

	(Dec.) 1876.	(March) 1888.
Gas lamps - - -	2,718	4,458
Oil lamps - - -	700	303
Total - -	3,418	4,761

It is difficult to give any accurate figures regarding tank filling, as the various censuses which have been made of tanks yield different results according as a smaller or larger area is adopted as the minimum size of "a tank." Practically, however, it may be said that tanks other than those in private enclosures are now very rare in any part of the town except the extreme north.

The policy of tank filling with refuse is due to Dr. Payne, who most strenuously urged this as far better than leaving the tanks unfilled and accessible to the people. His successors have accepted his views with constantly decreasing enthusiasm, the present Health Officer barely tolerating the measure, though the system has been much improved by experience. The number of tanks in the town, according to Dr. Payne's estimate made in 1877, was 800, of which 331 required to be filled up. Since then about 240 have been filled up, and practically there are very few tanks left in the town except in Wards Nos. 1, 3, and 4, excluding, of course, the tanks in the public squares, the water of which is comparatively pure.

The improvement in the matter of privies has been very great, partly owing to the large number which have been reconstructed under the pressure of the Health

Department, but mainly owing to the cleansing having been taken over by the Commissioners in 1877, and carried out by an establishment specially entertained for the purpose.

The benefit derived from this establishment has obviously been greatest where it was most needed. In the houses of most well-to-do persons the service is probably not much more efficient than it was when left to licensed tollah mehters, but poorer people often left their privies and cesspools uncleaned for months or even years, and a daily service, even if not thoroughly performed, must be an immense sanitary improvement, especially in the bustees. The number of public latrines has been slightly increased, but they have all been made free and a separate portion screened off for the use of females.

The improvements in bustees include most of the tank and privy improvements during the last decade; and as it is in the bustees that the greatest change has taken place, it is best to deal with the subject in a comprehensive way, and contrast the bustees of the town when the Justices made over charge, with the bustees as they are now. It is the simple truth to say that, up to the end of 1876, bustee improvement had been fought shy of. Its urgency was admitted, but the difficulties to contend against were too great. The report of 1876 reviews the question, and it may be well to quote it at length, and to indicate the improvements in the margin.

Report of 1876 *under head "The Sanitary Condition of the City."*

The cost of municipal conservancy amounts to no less a sum than Rs.1,55,100 per annum, but it remains to be explained that conservancy is *not at present attempted in the interior of the bustees.* It is a principle which appears to have been accepted without any opposition on behalf of the Commissioners of the different wards, that where the cart cannot go there can be no conservancy. The result is that, while the main thoroughfares are daily swept and watered, the interior of the ranges of huts on either side are in a condition which it is almost impossible to describe. Though some improvements have been effected during the last few years, there still remains an amount of work to be done which will require a considerable expenditure of money, and some time must elapse before the condition of the town can be permanently improved. The residents inhabiting the European portion of the town have no conception of the condition of parts of the native quarter. The Health Officer describes that condition as follows:—

"It is impossible to conceive a more perfect combination of all the evils of crowded city life with primitive filthiness and disorder than is presented in the native portion of Calcutta. Dirt, in the most intense and noxious forms that a dense population can produce, covers the ground, saturates the water, infects the air, and finds in the habits and incidents of the peoples' lives every possible facility for re-entering their bodies, while

The strictly parallel expenditure in 1887–88 exceeded three lacs!

Now refuse is removed, and the roads and drains swept out in the interior of bustees just as much as anywhere else, and the proportion of the amount referred to above, which was spent on bustee conservancy, was over half a lac.

As in the exaggerated style of writing which often finds favour with our sanitary reformers, at least an equally graphic description would be given of the present condition of the native town, it is not sought to found any argument on the *tone* of the description given by Dr. Payne, but attention to the details referred to will show that if the same language is still used, it applies to a radically different state of things.

ventilation could not be more shunned in their houses than it is if the climate were arctic instead of tropical."

The condition here described is generally applicable to the interior of the various blocks into which the city is divided. The city is intersected by several large thoroughfares which sub-divide the various wards into regular blocks of houses. While these main thoroughfares are clean, a few yards behind the first row of houses, the ground is occupied in some blocks by undrained lanes and houses, and in others by the so-called bustees. The question of bustee improvement has for a considerable time occupied the attention of the late Justices and more recently of the members of the existing Corporation. The matter has also attracted the attention of the Government of India and of the Secretary of State.

These have now been drained.

The problem before the Corporation is this: given a large town covered with houses erected without any semblance of order, teeming with a dense population, chiefly migratory, without latrines, and without any attempts at sweeping. All the refuse, both of the house and the cook-room, is thrown into open ditches filled with putrefying matters, and a black greasy slime often several feet in depth. Generally, in the centre of these blocks, there is a tank into which the sewage runs; on all sides there are privies which void their contents into the water. The Official Analyst's report shows that the water in many of these tanks is the character of London sewage. Shoals of worms are visible to the naked eye, and animalculi when the water is observed under a microscope. Every hour of the day the residents use this water for cooking purposes, for washing and cleaning their utensils, their persons, and their soiled clothes, in close proximity to the discharge of the sewage from the latrines.

This unfortunately applies still with full force. The new Act provides a remedy.

No longer applicable. Everything is now swept once a day.

All the open ditches have been sewered.

The refuse is all removed once a day.

The greasy slime of the ditches is gone.

Nearly all these tanks have been filled up.

The privy establishment removes the contents of the privies every day.

Scarcely anyone in the town now uses any but the Municipal water for drinking or cooking.

Let it be remembered that the proprietors of many of these bustees are poor, many are Hindoo widows, who cannot sell or part with their property, that the native is peculiarly jealous of what he regards as "the rights of property," and the question is how is the Corporation to deal with a vast area under these circumstances?

It will be seen from the above that if the same style of writing is in fashion now as then to describe the condition of the native town, nearly all the defects then referred to have been removed. Refuse still litters the ground, putting tidiness and neatness out of the question, because the Commissioners cannot make up their mind to prohibit refuse being thrown into the streets in the afternoon as well in the morning; but whereas formerly this refuse remained where it lay till it slowly rotted away, now it is removed every 24 hours. Then access by cart to the interior of the bustees was impossible; and as the passage quoted tersely puts it, it was taken as a first principle that where a cart cannot go, there can be no conservancy. Now every bustee of any considerable size is intersected with roads not nearly as wide as

they should be for health, but wide enough for carts to traverse and pick up the refuse, which is brought to the road side. Then the bustees were seamed with open drains, deep in black slime with privies voiding their contents into them. Now these drains have all been converted into sewered footpaths, metalled and swept, along which the mehters pass every day and remove the contents of the privies, which formerly voided into the ditches. The tanks in all but a few of the northern wards have been filled up, and replaced by neat bathing platforms, into which water comes straight from the river, and altogether the entire aspect of the bustees is transformed.

The bathing platforms just referred to are one of the greatest improvements of the last few years. Their object is to replace the tanks which have been filled up, and give the bustee populations the means of bathing in comparatively pure water. They are now 86 in number, and are much appreciated by the lower classes. One very excellent feature of them is the provision of separate accommodation for males and females, and the protection of the latter from public view while bathing.

In 1876 there were 10 public squares in the town south of Bow Bazar and 4 in the north of it; in all 14. Now there are 12 in the south and 7 in the north; in all 19. Another has been sanctioned, and the land is in course of acquisition.

The tramways of Calcutta are all the work of the last 12 years. Many persons, however, would be disposed to deny that they can be looked upon as an improvement. In truth, they are a great sacrifice of the convenience of that portion of the public which uses its own carriages in favour of that portion which does not. As the latter is in an enormous majority, the tram cars may be looked on as ministering to the greatest happiness of the greatest number. In all 15 miles of tram lines have been laid down, which pay the Corporation Rs. 42,500 per annum. They do not, however, yield a good profit to the company, as it purchased the concession at a very high price.

The slaughter-house and the new market both date from the time of the Justices, and the former of them was yielding an annual profit of Rs. 26,856, or 12 per cent. on the outlay in 1876. It now yields a net annual profit of Rs. 30,000, or over 13 per cent. The new market, however, has been developed by the Commissioners into a valuable property, instead of a losing investment as it was in 1876. In para. 103 of the annual report by the Commissioners for 1877, the financial aspect of the Municipal Market was discussed, and it was shown that in the four years ending 1877, the two markets taken as a joint project had cost the Commissioners, allowing interest, &c., Rs. 1,57,878, excess expenditure over receipts; in other words, the net return was only $3\frac{1}{2}$ per cent. on the outlay. The gross receipts have been worked up from Rs. 98,735 in 1877 to Rs. 1,41,491 in 1886, and the net income to Rs. 1,16,812, or about $7\frac{1}{2}$ per cent. on the total outlay, including compound interest. In 1887 the greater part of the old Dhurrumtollah market has been sold at about 22 years' purchase of the profit which it was yielding, so that the residue of the profit will return at least 8 per cent. on the residue of the capital sunk.

The question naturally arises what has been the effect of these great improvements on—(1) the health, (2) the wealth of the town. Taking these as tests, do they bear out the claim to improved conditions, which has been set forth in the foregoing paras.? As regards health the answer is only fairly satisfactory owing—(1) to the vagaries of cholera, the causes of which are still so imperfectly known; (2) to a tendency to increase among deaths due to miscellaneous causes which would indicate that the resident, as compared with the floating population, is on the increase. It is believed that this is the case, but the next census must be awaited before it can be regarded as demonstrated.

The following table gives the mortality as officially reported year by year from 1876 to 1887:—

Cholera, after being shown separately from diarrhœa and dysentery, is afterwards combined with them, because there is no scientific diagnosis of the cause of death in most of the Calcutta mortality; and there can be no doubt that many deaths from diarrhœa are reported as cases from cholera and probably *vice versâ*. The fact, which is almost invariably observed, that deaths from diarrhœa and dysentery drop to a minimum in seasons of heavy cholera mortality, indicates that many deaths belonging to the former are being ascribed to the more prevalent malady.

Years.	Deaths due to				
	Cholera.	Diarrhœa and Dysentery.	Cholera, Diarrhœa, and Dysentery combined.	Fever.	All Causes, including foregoing, excluding Still Births.
1876	1,851	1,864	3,715	4,361	12,524
1877	1,418	1,683	3,101	5,151	13,225
1878	1,338	2,010	3,348	6,086	15,899
1879	1,186	1,516	2,702	4,796	12,615
Total 1876 to 1879	5,793	7,073	12,866	20,394	54,263
1880	805	1,267	2,072	3,797	11,184
1881	1,693	1,491	3,184	3,765	12,528
1882	2,240	1,454	3,694	3,618	12,678
1883	2,037	1,307	3,344	3,442	11,784
Total 1880 to 1883	6,775	5,519	12,294	14,622	48,174
1884	2,272	1,209	3,481	3,618	12,694
1885	1,603	1,655	3,258	3,831	12,707
1886	1,741	1,258	2,999	3,422	11,447
1887	1,198	1,197	2,395	3,253	10,979
Total 1884 to 1887	6,814	5,319	12,133	14,124	47,827

The 12 years are divided into three quadrennial periods, and separately totalled for convenience of reference. It will be seen that under the head of fever (by far the largest cause of mortality), the improvement has been marked and continuous. This may be safely attributed to the completion of the drainage, the consequent obliteration of the surface ditches, the increased dryness of the subsoil, and the work done by the organised mehter service. The figures are entirely borne out by common experience. The comparative immunity from fever enjoyed by residents in the town, as compared with residents in the suburbs and the mofussil, is so notorious that persons suffering from fever in the interior frequently come to Calcutta under medical advice as to a sanitarium.

If the figures of diarrhœa and dysentery can be taken as reliable, the mortality from this cause shows almost an equally gratifying improvement, while the mortality from cholera shows a converse tendency to increase. If, however, cholera, diarrhœa, and dysentery ought to be combined, owing to the very imperfect diagnosis, then the figures of the three periods are 12,866, 12,294, 12,133, showing a slight but very slight tendency to improve.

As regards general mortality, the figures are corrected so as to exclude throughout still-births, which were formerly included, but since 1885 have been excluded from the return. It will be seen that, comparing the first quadrennial period with the second and third, the improvement has been very great, while there has also been a slight improvement in the third as compared with the second. Taking the figures all round it may fairly be said that they indicate considerable improvement in the sanitary condition of Calcutta during the 12 years, though the improvement would be much more decisive were it not for the baffling results of cholera.

Much more decisive, however, has been the result, if the effect of these improvements as regards the wealth of Calcutta is looked to. This test may be taken first from the point of view of the private owner, then from that of the municipality as a corporate body. As regards the private owner, the increase in the value of property in Calcutta has been most conspicuous. The value of the bustees which have been improved has gone up 100, 150, 200, and in some cases 300 per cent. Wherever new roads have been constructed, the value of the adjacent property has increased rapidly, and it may be taken as a very moderate estimate that, on the whole, the value of land in Calcutta has doubled since 1876. This simply means that, though the population of Calcutta has been practically stationary, the advantages attaching to the land within its limits have been so increased, whether for residential or business purposes, that a site will now fetch on the average twice as much as it would have done 12 years ago. That price still varies enormously with the situation, the value as a general rule

increasing as one nears the river bank, and decreasing as one nears Circular Road. It is probable that Rs. 500 a cottah is a fair all round estimate for the value of land in 1876, and Rs. 1,000 a cottah in 1888; and if so as, excluding roadways and the maidan, there are about 1,80,000 cottahs of land in Calcutta, the enhanced value to the owners according to this computation would be Rs. 90,000,000, or nine crores of rupees. It would be difficult to produce a more decisive tribute to the wisdom of municipal improvement.

As the value of buildings has not risen *pari passu* with the land on which they stand, and as houses are only reassessed every six years, it is not to be supposed that the valuation of the town for assessment purposes will show an increase proportioned to the increase in the market value of the land. Still the increase, even in the official valuation of the town, has been such as to assure the Corporation a return more than sufficient for the outlay incurred. In 1876 the valuation of the town was Rs. 1,23,32,344. At the end of 1887–88 Rs. 1,43,75,673. Thus the same rate of taxation is now 15 per cent. more productive than it was in the earlier period. The debt of the town, on the other hand, in spite of the very large expenditure on drainage and water works described above, has not increased disproportionately. At the end of 1876 it stood at—

		Annual Interest charges.
	Rs.	Rs.
6 per cent. Debentures borrowed from the public -	54,99,600	3,29,976
4½ „ „ from Government - -	43,67,795	1,96,035
4 „ „ „ - -	52,00,000	2,08,000
	1,50,67,395	7,34,011

At the end of 1887–88 the figures are—

6 per cent. Debentures - - - -	8,22,500	48,000
5 „ „ - - - -	94,98,900	4,72,750
4½ „ „ - - - -	10,48,300	47,173
4¼ „ consolidated Government loan - -	64,09,482	2,72,425
	1,77,79,182	8,40,348

Thus whereas it took a 6 per cent. rate in 1876 to meet the interest charges at that time, a 6 per cent. rate now would cover the parallel charges and leave a margin.*

Summarising therefore the foregoing paras., it appears that during the last 12 years the drainage scheme has been completed, the filtered and unfiltered water-supply doubled, the roads considerably increased in length and better lighted and watered. Nearly all the most dangerous tanks have been filled up, and the town has been studded with bathing platforms for the use of the poorer inhabitants. All the large bustees have been pierced with cart roads and their refuse is removed daily; privies have been reconstructed throughout the town according to improved models, and are regularly attended to by a daily establishment; the risk of fever, if not of other zymotic diseases also, has been considerably decreased, the value of land to the landowners has been doubled, and all this achieved without subjecting the ratepayers to any heavier burden on account of debt than they had to bear at the beginning of the period under review.

Notwithstanding the heavy expenditure on improvements, the credit of the Corporation stands very high in the market. Its financial policy has given entire confidence to its creditors, and its last 5 per cent. loan is being quoted at 108! May it not be claimed that the government of Calcutta by a municipality, partially elective, has been attended by marked success, and can it be said that the Commissioners, in handing over the town to their successors, have any reason to be ashamed of the results of their rule?

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* There was, however, a reserve fund of Rs. 23,57,542 in 1876, against a reserve fund of only two lacs more or less at the end of 1887–88, but this made no diminution in the annual interest payable.

Town Improvement.

Previous to 1886–87 the funds available for improvements consisted only of the Rs. 30,000 allotted for petty Town Improvements, and Rs. 1,50,000 allotted for bustee structural improvements, and bustee cleaning establishments. In that year it was resolved to borrow 2½ lacs annually, debiting the interest to the Rs. 1,50,000, so as to complete the improvements of the town more rapidly. Accordingly, the funds available during 1886–87 amounted to Rs. 3,53,622-0-4. The expenditure during 1886–87 was only Rs. 2,03,244-9-11. Thus there was a balance of Rs. 1,50,377-6-5 on the 1st April 1887, which raised the amount available for expenditure in 1887-88 to Rs. 5,95,196-15-2. The expenditure actually incurred as adjusted in the accounts was Rs. 3,33,416-11-3 leaving a balance of Rs. 2,61,780 for the current year.

The following statement summarises the bustee works which were done during the year under the provisions of sections 280–283 :—

Durmahatta Bustee, the rest of the improvements completed; Sickdarpara Bustee, all the improvements completed; Keranee Bagan Bustee, the roads that remained incomplete were all completed; Ooryapara Bustee, the works originally proposed to be done at the cost of the Corporation completed, and two of the roads nearly completed at the cost of the owners; Sova Bazar Bustee, all the roads, seven in number, taken up and completed; Hanspukur Bustee, all the improvements completed; Puchagully Bustee, the improvements nearly completed; Moydaputty Bustee, works taken up in hand at the close of the year; Soorhatta Bustee, the works that remained incomplete taken up at the close of the session; Goa Bagan Bustee, works taken in hand by the owners.

The following statement shows at a glance the stages arrived at up to the close of the year in each of the bustees which were being dealt with under the provisions of sections 280–283 :—

Improvements nearly completed.

1. Soorhatta Bustee.
2. Ooryapara Bustee.
3. Puchagully Bustee.

Improvements commenced.

4. Goabagan Bustee.
5. Moydaputty Bustee.
6. Moydatolee Bustee.
7. Moonshetolao Bustee.

Projects finally approved, but Works not commenced.

8. Machooa Bazar Bustee.
9. Rajbullubpara Bustee.

Orders issued to draw up the Draft Projects.

10. Bustee north of Manick Bose's Street.
11. Bustee south of Manick Bose's Street.

Orders issued requesting the Medical Officers to modify their First Report.

12. Mothoor Sen's Foolbagan Bustee.

Report of the Medical Officers before the Committee.

13. Blocks of bustees in Hastings.
14. Two Bonamally Sircar's Street Bustee.
15. Rajabagan Bustee excepting the north-west block.
16. Nundon Bagan Bustee.

Orders issued to inspect the Bustees under Section 280.

17. No. 1 Bonomally Sircar's Street Bustee.
18. Radha Mullick's Bagan Bustee.
19. Gopee Mohun Bose's Lane Bustee or Molunga Bustee.
20. Hareepara Bustee.
21. Komedan Bagan Bustee.
22. Bustee north of Baug Bazar Street, to be inspected after the drainage improvements have been completed.

Shaikpara Bustee.—The improvement of the bustee proper has been completed during the year. Possession of land for the erection of bathing platform and latrine was received from the collector under Act X of 1870 after the close of the year.

The following is the statement showing the condition of bustee reclamation on the 31st March 1888:—

Number.	Area.	How dealt with.
2	173	Improved from drainage.
2	35	do. under section 283-A.
23	520	do. do. 280–283.
3	32	do. by the owners.
2	8	do. as town improvements.
14	436	In various stages of progress under sections 280–283.

Tank filling and Bathing Platforms.—Eighteen tanks have been filled up by the Corporation during the year and 10 by the owners; besides the above, three tanks were being filled up by the Commissioners and seven by the owners at the end of the year. One tank has also been de-watered, which will be filled up during the current year. The owners have de-watered and improved 10 tanks during the year under report.

At the beginning of the year, 69 bathing platforms were in working order. Great efforts were made to increase the number to 75, and the Commissioners have now put up more than what they first contemplated.

The state of things at the close of the year was as follows:—

	No.
(*a.*) Number completed and connected with piping and actually working	80
(*b.*) Completed but not connected with piping	1
(*c.*) Completed but made over to the owner of No. 6 Hill's Lane	1
(*d.*) Sites obtained and platforms under construction	2
(*e.*) Put up by private owners	2
Total	86

Besides the above, the Commissioners have issued orders to put up four more bathing platforms in Ward Nos. 2 and 7. The total sum spent by the Commissioners in erecting bathing platforms as adjusted in the accounts up to 31st March 1888 was Rs. 1,24,145-1-4.

Street Improvements.—The street improvement grant from revenue was as usual Rs. 30,000. This is for petty improvements only; all larger and more important constructions are undertaken from the drainage budget. These improvements are, of course, also independent of all works carried out as bustee improvements. The expenditure incurred on this account, as adjusted during the year, was, however, Rs. 55,848-11-8, or 25,848-11-8 in excess of the grant.

Waterworks.—During the year under report, and especially at the close of it, the extension works were, so far as the patience and satisfaction of the public are concerned, at their most critical stage. Nearly the whole of the capital required for the extension has been borrowed. Interest is being paid for on it, the greater part of the new works are completed, but as entire completion is necessary before fruition, it has only been possible to raise the average supply of filtered water from 8,106,525 gallons per diem as it was in 1885–86 and 9,116,845 as it was in 1886–87 to 10,330,525 in 1887–88, instead of nearly double that amount as it will be in a few weeks' time.

When the waterworks were first constructed, interest was met out of capital. As long as the works were in preparation, and, therefore, till the water came, no taxation was imposed. Under the present municipal law, this is not possible, and the full taxation has to be paid, while scarcely more than half the water is supplied.

To give the full supply of at least 20,000,000 gallons per diem, it is necessary to have—(*a*) the machinery to pump up this water from the river at Pultah; (*b*) a sufficient area of settling-tanks to settle it there; (*c*) a sufficient number of filters to filter it; (*d*) sufficiently large mains to convey it, when filtered, to Tallah; (*e*) sufficient engine power at Tallah to drive the water into Calcutta; (*f*) sufficient engine power in Calcutta to distribute it satisfactorily in all parts of the city, and (*g*) the piping in the town sufficiently enlarged and extended to convey the increased supply to each street and house.

As regards (*a*) three new engines are being erected at Pultah. These, with those previously erected, will suffice to raise 20,000,000 gallons daily from the river, and give at least one engine as stand-bye. As soon, therefore, as these three engines are ready to work, this stage will be completed. As a fact these engines are just erected and beginning to work as this report is being written.* (*b*) Settling tanks for the full supply have been ready for some time past. Here, therefore, there will be no hitch. (*c*) The filters work much more efficiently during the cold weather and dry weather months than during the rains when the river is very muddy. Hence during (say) 300 days in the year, 24 filters will easily pass 20,000,000 gallons of filtered water, but during the remaining (say) 65 days, they will only pass 12,000,000 to 15,000,000 gallons. Therefore, to ensure the filtration of 20,000,000 gallons daily during the worst days of the year, at least 36 filters are necessary. This, therefore, is the maximum number contemplated in the extension scheme. As, however, the maximum supply cannot be disposed of at Tallah till after the rains of 1888 are over, there will be no strain on the filters for another 12 months, and though they are not yet completed, they are in as forward a stage as circumstances require; 16 have been in use for some time past. Four more have just been brought into use, and the last 16 are in an advanced stage and will be completed next cold weather. Want of filtering arrangements will not, therefore, retard the supply. (*d*) The mains for conveying 20 million gallons to Tallah have been in use for some time past, and no impediment will therefore occur at this stage. (*e*) The stage at which delay will occur as soon as the Pultah engines are in full working, is at Tallah, whence the supply is delivered to the whole town. The engine-power requisite for this station is four 75-H.P. engines, which will pump 28,000,000 to 30,000,000 gallons in 24 hours, and thus allow one engine as stand-bye. Before the extension works there were three 50-H.P. engines and one 75-H.P. It was resolved as part of the project to transfer the three 50-H.P. old engines to Halliday Street, and replace them by two new 75-H.P. engines at Tallah, as well as to order out one additional 75-H.P. This last engine has been erected, and is working, linked with the old 75-H.P., and these two engines are all that the town has to rely on for this stage of its supply till the three 50-H.P. have been taken to pieces and the two new 75-H.P. erected in their place. The new engines have arrived, the old ones have been dismantled, and the erection of the new ones commenced; but till these are ready for work, there will only be two engines available, and they cannot dispose of more than 14,000,000 or 15,000,000 gallons daily. The new engines should be ready for work in all October. (*f*) The only subsidiary pumping station we now have in Calcutta is at Wellington Square, and experience has fully shown that with the large increase in connexions, Tallah working with Wellington Square, is not able to meet the needs of the riparian wards. A new pumping station is therefore being erected at Halliday Street for this purpose, and till this is ready and in working order, even if the 20,000,000 gallons are sent down, they cannot be satisfactorily and efficiently distributed. These works are in a forward stage, the engines which have been dismantled at Tallah are in process of re-erection, and they ought also to be ready to work in all January. (*g*) Though the necessary adjustments of the arterial pipes in the town are complete, some of the pipes to carry the water into the smaller streets and lanes that have not at present got any supply are not yet down. They cannot be put down till the extended supply is given, as they would otherwise weaken the pressure. The want of these pipes will not in any way prevent the several parts of the town from benefiting by the new works, but it will deprive individual houses of this benefit till these pipes are put down.

The outcome of the above description is that the supply can be immediately increased to 13,000,000 or 14,000,000 gallons, but this, during the rains, is scarcely needed. That 13,000,000 or 14,000,000 gallons will be delivered after the rains until

* They are all those regularly working now—18/9/88.

the new engines are in their place at Tallah in October, and that in by February at latest the town ought to be enjoying its full supply of 16,000,000 gallons properly distributed by the aid of the engines at Halliday Street.

The remaining 4,000,000 are intended for the suburbs. Hitherto they have done nothing to receive their supply, but arrangements are now being made to put down such of the distribution pipes as will be attached directly to the town pumping stations. The above account shows that the Commissioners can supply them with whatever amount of water they are in a position to take, as soon as they are ready for it.

Why were the works not all finished simultaneously? The criticism has frequently been heard during the year under review that it shows very bad management on the part of the Commissioners that the works have not all been finished about the same time. This illustrates the proverbial shortness of memory of the general public. It is forgotten that this is precisely what the Commissioners endeavoured to accomplish, but what their inability to raise loans in the then condition of the money market frustrated three years ago. The Commissioners were so urgent in pressing on the works that they entered into contracts in excess of their funds, and were only saved from serious embarrassment by a temporary loan of 5 lacs from the Government of India. They then represented the urgency of pushing on with *all* the works, and begged the Government to guarantee the requisite funds temporarily, to be repaid as soon as the money market admitted the floating of a loan on reasonable terms. This, however, the Government peremptorily refused to do, though they showed much consideration in regard to the 5 lacs already advanced. Thus the present delay in completing the works is solely due to the condition of the money market in 1883–84. From the time that funds became plentiful, all the works have been pushed on as fast as circumstances have admitted.

The average daily supply of filtered water to the town has been as follows:—

	Gallons.		Gallons.
1870 - -	3,011,969	1885–86 - -	8,106,515
1875 - -	6,205,542	1886–87 - -	9,116,847
1880 - -	7,407,256	1887–88 - -	10,530,525

There has, therefore, been a continuous increase, while the population of the town has remained stationary, an increase greater than the figures show, because during the past five years a very large quantity of filtered water used for watering streets and flushing latrines and privies has been replaced by unfiltered water; but while the total quantity consumed has increased, the distribution has gone from bad to worse, owing to the increasing number of connexions and the increasing consumption of water in the houses which have connexions. According to existing arrangements, the east of the town taken as a whole obviously has the command of the water before it can penetrate to the western wards, and the size of the ferrules, though by no means unusual, is still sufficiently large to give the power of taking the whole supply, if the residents choose to use it. Though not abused to the extent of the whole of the supply, still the power is so far used as very seriously to deteriorate the supply in the west of the town, and as the number of connections in the east has gone on increasing, the supply to the west has necessarily gone from bad to worse. The new Halliday Street pumping station should effectually remedy this.

The cost of the water which was as high as Rs. 305 per 1,000,000 gallons in 1875, whence it gradually fell to Rs. 141 in 1882–83 before money was borrowed for the new extension works. Since then the heavy interest charges have raised it year by year to Rs. 215 in 1886–87; Rs. 250 per 1,000,000 gallons is equal to 4 annas per 1,000 gallons.

These figures show the immense value of the boon which the waterworks have proved to the town. Experience shows that whenever houses situated outside the town can get filtered water from the town supply, they willingly pay R. 1 per 1,000 gallons for it, and the Commissioners receive a large sum annually for the water sold in this way. The town has for years past enjoyed the same water at an average cost of 3 annas per 1,000 gallons, but as the non-connected residents and large properties, such as the Port Commissioners or the High Court, have been clearly shown to get much less water than they pay for, some connected houses have been getting filtered water at little over 1 anna per 1,000 gallons!

As soon as the full supply comes in, the average price of the water will fall from its present figure of 3½ annas per 1,000 gallons to about 2 annas a 1,000 gallons, at which

price the suburban residents incorporated with the town will be supplied. In this alone there will be a saving to such as now obtain it of 14 annas per 1,000 gallons.

Since the enlargement of the unfiltered supply-pipes, the average daily supply to the town rose from 1,869,911 gallons in 1886-87 to 2,501,830 in the year under report. Very good pressure is maintained throughout the town, and the bathing platforms and latrines are well supplied.

Drainage.—The drainage works in the town are virtually completed just as the amalgamation comes into force, and fresh drainage operations have to be taken in hand for the new area. The Hastings drainage has been completed, and that of Baug Bazar is rapidly approaching completion. The total expenditure from capital on drainage construction in 1887–88 has been Rs. 2,14,843-4-1.

Roads, &c.—Roads, sewered ditches, squares, watering, tree-planting, are all increasing, while the flushing of the sewers is being made more and more effectual by converting manholes into flushing chambers.

Sanitation.—The results of the year show that it was on the whole the healthiest on record. The mortality was only 10,979 or 25·3 per 1,000, being less than even in the phenomenally healthy year 1880. In the suburbs, on the other hand, the mortality was higher than it was in 1886, 1883, and 1882; unless, therefore, there has latterly been an alteration in the relative populations of the two localities, this improvement furnishes some reason for hoping that the transfer of the conservancy to the Health Officer, and the increased expenditure on sanitation, has been productive of good results.

The Commissioners are also glad to observe that not only was the cholera mortality very low, lower than in any year since 1880, but also that the year was marked by a further fall in the death-rate from fever. Just as the caprices of cholera, and the uncertainty that prevails as to its causation, mark it out as an especially unsafe test of the result of ordinary sanitary measures, so the effect of municipal improvements has been so steady and uniform on the mortality from fever as to indicate this mortality as the best and surest test of sanitary progress.

It is well known that the common experience of the inhabitants of Calcutta is that it is quite a different place from what it used to be in its liability to fever. Numbers of native gentlemen have chosen it as their residence in consequence of the immunity from fever which they enjoy in it, and it is often prescribed as a fever sanitarium to residents in the interior, but those who prefer the evidence of figures to common experience and report cannot fail to be convinced by the following figures of the last decade:—

Year.	Fever mortality.	Year.	Fever mortality.
1878	6,086*	1883	3,442
1879	4,796	1884	3,618
1880	3,797	1885	3,831
1881	3,765	1886	3,422
1882	3,618	1887	3,253

* This was exceptionally high; the average of the five years 1873 to 1877 was 4,866.

There can be scarcely any doubt that this is mainly due to the underground drainage, and the increased dryness of the subsoil resulting therefrom.

As regards cholera the evidence, as marshalled by the German doctors, is very strongly in favour of its being mainly due to water. It has been contended with great force by Dr. J. M. Cuningham, the late Sanitary Commissioner with the Government of India, that the great fall in the cholera mortality in 1869 and 1870 was due to other causes besides water-supply. He maintains that not merely was this fall very pronounced before one drop of filtered water reached Calcutta, but also that it attained its climax in the town when the water was but very sparingly used, and it was as conspicuous in the Fort, where the arrangements made for the water-supply in 1865 were still unchanged. But although the special and sudden drop in 1869 to 1870 may be due to a very small extent only to the filtered water, it seems evident that the *average* immunity from cholera since 1870, as compared with the earlier period, is plainly attributable to the water-supply. This is entirely borne out by the experience of the Fort, where the improved arrangements for water-supply made in 1865 were followed by conspicuous improvement in regard to cholera, and the introduction of the filtered municipal water in 1872 by further improvement.

This theory also is thought to harmonise with the tendency to a slight increase in cholera in the ninth as compared with the eighth decade of the century. Though the consumption of filtered water in Calcutta is far greater now than it was in the period 1870 to 1879, it is doubted whether the consumption for drinking purposes only is greater. When the connexions were few, all the hydrants in the town had an abundant supply, and the hydrants are the chief means of supply to the lower classes, who can only use the water sparingly for drinking and cooking purposes. As the connections have increased and multiplied, the supply of water in the hydrants most remote from the pumping stations, *i.e.*, in the west of the town, has fallen off, and a few of them have become quite dry. It is possible, therefore, that the lower classes can get less filtered water for drinking than formerly, when the supply was much less abundant, and if so, this would account for the partial reaction. This is evidently the view favoured by the German experts, and although it would be premature to say that it is certainly correct, it seems fairly probable.

It also receives very strong corroboration from the Health Officer's report. Dr. Simpson has compiled the statistics of the mortality from cholera among the residents in pucca houses and tiled huts, and contrasted them with one another. The result is that among 1,867 deaths from cholera inquired into between August 1886 and March 1888, 1,373 were of persons living in tiled huts and only 493 in pucca houses. Now, as the population of the latter somewhat exceeds that of the former, this shows a very marked excess of mortality among the dwellers in tiled huts. This result is fertile of instructive inferences.

(1.) In the first place the figures tend to show that the supposed immunity of the Waterloo Street and Park Street Wards is in some measure due to the greater prevalence of pucca houses in those wards. Taking the residents of pucca houses and the residents of tiled huts separately, the order of healthiness comes out as follows:—

	Percentage of Cholera mortality.		Percentage of Cholera mortality.
Pucca houses.		*Pucca houses.*	
Bamun Bustee - -	0·3	Waterloo Street - -	1·2
Colinga - -	0·7	Park Street - -	1·4
Fenwick Bazar - -	1·1	Hastings - - -	1·5
Kutcha houses.		*Kutcha houses.*	
Bow Bazar - -	3·0	Shampooker - -	5·5
Taltollah - - -	4·2	Coomertolly - - -	5·8
Hastings - -	4·5	And worst of all—	
Fenwick Bazar - -	5·0	Park Street - -	14·2
Colinga - - -	5·2		

It is quite evident that these figures do not extend over a sufficient length of time to afford any safe index as regards individual wards, but they do afford strong ground for the conclusion that the relative healthiness of the wards of the town as regards cholera depends far more on the proportion of bustee area in that ward than on its situation.

(2.) The figures also bear out what the Commissioners have over and over again urged, that the chief difficulty they have to contend against in removing the causes of cholera is poverty. There can be no doubt that the residents in tiled huts are the poorer portion of the population, and if that portion of the population is separately considered which can afford to live in pucca houses, the mortality from cholera at once falls 70 per cent. Dr. Simpson's figures indicate that the main cause of the large mortality from cholera in Calcutta at the present time is to be found in the insufficient shelter, poor food, squalid surroundings, and negligent habits of the poorer classes. The poorer residents in pucca houses are often very poor, but on the average the difference between the condition of the two is enough to give the latter *in all quarters* of the town an immunity from cholera equivalent to 70 per cent.

(3.) Foremost among these defective surroundings must be placed the want of filtered water; scarcely any tiled huts in the town are connected with the filtered supply, while the great majority of the pucca houses have connexions. That this is the only cause of the difference between the mortality of the two classes—a view to

which Dr. Simpson seems to incline—does not seem to the Commissioners tenable, looking to the figures of such Wards as Fenwick Bazar, Taltollah, Collinga, Park Street and Bamun Bustee. In none of these wards is there any scarcity of water; it may safely be assumed that the inhabitants of the bustees, as much as of the pucca houses, use the filtered water for drinking and cooking. Yet the difference between the mortality among residents in pucca and kutcha houses is almost more marked there than in the wards in which the hydrants have a bad supply and the poorer classes have difficulty in procuring water.

It will be seen that, whereas a scarcity of water is reported to have been found in 89 out of the houses in Coomertolly, in which 141 deaths occurred, and in 100 of those in Burra Bazar, in which 260 deaths occurred, it is only reported in 11 out of the 179 in Fenwick Bazar, Colinga, Park Street, and Bamun Bustee, and even in those 11, it is difficult to credit the accuracy of the report so far as drinking water is concerned.

It seems clear that though the figures indicate that water has much to do with the prevalence of cholera, they also indicate that poverty and the squalid surroundings which result from it, have also much to do with it, even where the supply of filtered water is ample, and that at any rate, so far as this disease is concerned, it can never be said that—

* Pallida mors æquo pulsat pede pauperum tabernas
Regumque turres.

It should therefore never be forgotten that the truest sanitary reformers in Calcutta are those who put most money into the pockets of the poorer classes, and thereby raise their standard of living, and above all, that any sanitary improvements, the tendency of which is to impoverish the poor, necessarily defeat their own object.

It must also be noticed that the statistics in Dr. Simpson's table are defective in a way which may seriously impair their value. He has only inquired into about three-fourths of the cholera deaths which occurred during the period under report. Are these three-fourths a fair representation of the entire mortality? If the residuary fourth is proportionately more in pucca than in kutcha houses or *vice versâ*, or more in some wards and less in others, it is evident that the value of the *comparative* results is vitiated both as regards the relative position of the ward and the ratio between pucca and kutcha houses.

Similarly the statement is defective in not stating the number of houses in which these 1,867 deaths occurred. A series of columns are given, showing the number of houses where deaths occurred—(1) in which there were wells, (2) which were close to tanks, (3) in which there was a scarcity of water, (4) which were furnished with taps, and (5) in which the drainage was choked; but as the total number of houses is nowhere stated, the requisite proportions cannot be ascertained. It may perhaps be inferred that the 1,867 occurred in about 1,800 separate houses.

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* Pale death impartially traverses the huts of the poor and the mansions of the rich.—(Horace.)

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1887.

(*Dr. W. J. Simpson.*)

Vital statistics.

The number of births registered in 1887 was 7,954 against 7,827 in the preceding year. This figure exceeds that of other years, except 1884 and 1885, when there was registered 8,290 and 8,358 births respectively. The birth-rate was equal to 18·3 against 17·3, the mean of the decade.

During the year the registration of births and deaths was transferred from the Police to the Health Officer's department. With reference to the registration of deaths the same system continues which I referred to in my last Annual Report, in which the death returns are compiled from the registers of the ghat and burial grounds. As explained in my last report, I do not think the system conducive to accuracy either as regards numbers or as regards the locality in which the deaths take place. This I think is only to be obtained by compulsory district registration.

Statement of Deaths from the most prevalent Diseases from 1877 *to* 1887.

Years.	Cholera.	Diarrhœa and Dysentery.	Fevers.	Small-pox.	Other Causes.	Total Deaths exclusive of Still-births.	Ratio per 1,000 of Population, Census of 1881.
1877	1,418	1,683	5,151	67	4,906	13,225	30·5
1878	1,338	2,010	6,086	1,495	4,970	15,899	36·6
1879	1,186	1,516	4,796	772	4,345	12,615	29·1
1880	805	1,267	3,797	114	5,201	11,184	25·8
1881	1,693	1,491	3,765	133	5,446	12,528	28·9
1882	2,240	1,454	3,618	17	5,349	12,678	29·2
1883	2,037	1,307	3,442	73	4,925	11,784	27·2
1884	2,272	1,209	3,618	478	5,117	12,694	29·2
1885	1,603	1,655	3,831	155	5,463	12,707	29·3
1886	1,741	1,258	3,422	15	5,011	11,447	26·4
Mean numbers	1,633	1,485	4,152	332	5,073	12,676	29·2
1887	1,198	1,197	3,253	2	5,329	10,979	25·3

The general mortality during the year was low, and was considerably under the mean of the decade. The number of deaths registered amounted to 10,979, giving an annual death-rate of 25·3 against a decennial mean of 29·2. This death-rate is lower than any reached during the past 10 years. The deaths recorded from small-pox, fevers, bowel complaints, and cholera, were all below the mean of the decade.

With the exception of Colootollah Ward, there has been a decline in the death-rate of all the wards. Colootollah, on the other hand, shows an increased death-rate; its decennial mean was 32·5, whereas its death-rate has risen this year to 35·2. It is occupied by native traders, and by a very poor class of permanent inhabitants, Natives and Eurasians. It is one of the filthiest wards in town, and among densely crowded wards in the northern portion of the town is the most crowded. The European wards present their usual low death-rates.

Deaths according to Race for the year 1887.

Nationality.	Population.			Deaths.			Ratio of Deaths per 1,000 of Population.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Non-Asiatics - -	9,193	4,658	13,851	97	57	154	10·5	12·2	11·1
Mixed Races - -	4,515	4,389	8,904	165	148	313	36·5	33·7	35·1
Hindoos - -	1,80,084	98,678	2,78,762	4,410	3,129	7,539	24·4	31·7	27·0
Mahomedans - -	90,667	33,763	1,24,430	1,608	1,209	2,817	17·7	35·8	22·6
Other Classes - -	4,358	2,914	7,272	87	69	156	19·9	23·6	21·4
Total - -	2,88,817	1,44,402	4,33,219	6,367	4,612	10,979	22·0	31·9	25·3

The difference in mortality between the races is considerable. Non-Asiatics have a death-rate of 11·1. Mixed races, who are the most permanent residents in Calcutta, have a death-rate of 35·1, Hindoos 27·0, Mahomedans 22·6, and other classes 21·4. It will be observed that the females of Hindoos, Mahomedans, Non-Asiatics, and other classes have a higher death-rate than the males, whereas the males of mixed races die faster than their females. It is also worthy of notice that the death-rate of female Mahomedans is more than double the death-rates of male Mahomedans, while the death-rate of female Hindoos is to male Hindoos as 31 to 24.

The following is a statement of the deaths according to age. As usual, the infant mortality is conspicuous for its high rate.

Ages.	Population.			Deaths.			Ratio of Deaths per 1,000 of Population per annum.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Combined.
Born dead - -	—	—	—	317	249	566	—	—	—
0—1 - -	3,185	2,902	6,087*	1,313	1,113	2,426	412·2	383·5	398·5
1—4 - -	10,858	10,756	21,614	541	508	1,049	49·8	47·2	48·5
5—9 - -	14,472	12,963	27,435	206	190	396	14·2	14·6	14·4
10—19 - -	40,189	20,734	60,923	356	313	669	8·8	15·0	10·9
20—39 - -	152,293	56,774	209,067	1,715	871	2,586	11·2	15·3	12·3
40—59 - -	57,545	30,048	87,593	1,286	649	1,935	22·3	21·5	22·0
60— - - - -	10,275	10,225	20,500	950	968	1,918	92·4	94·6	93·5
Total and general ratios - -	288,817	144,402	433,219	6,367	4,612	10,979	22·0	31·9	25·3

Infant Mortality under One Year of Age.

—	Population.	Number of Deaths.	Ratio per 1,000 of Population per annum.	Ratio on estimated Births.
Hindoos - -	3,963	1,620	408·7	289·7
Mahomedans -	1,446	666	460·5	315·0
Christians - -	607	104	171·3	146·0
Other classes -	71	36	507·0	336·4
Total - -	6,087*	2,426	398·5	284·6

According to season the highest general mortality was in January and December, the lowest in June; the highest cholera mortality was in March and April, the lowest in June; while the highest mortality from bowel complaints was in January and December, corresponding with the most unhealthy months of the year, when the temperature was low and the humidity comparatively high.

Comparative Mortality in the Town of Calcutta and its Suburbs from 1877 *to* 1887.

Years.	Town.		Suburbs.	
	Actual Number of Deaths.	Ratio per 1,000 of Population.	Actual Number of Deaths.	Ratio per 1,000 of Population.
1877	13,225	30·5	14,025	55·7
1878	15,899	36·6	17,459	69·4
1879	12,615	29·1	13,835	55·0
1880	11,184	25·8	11,216	44·6
1881	12,528	28·9	11,143	44·3
1882	12,678	29·2	10,470	41·6
1883	11,784	27·2	10,429	41·4
1884	12,694	29·2	11,389	45·2
1885	12,707	29·3	11,267	44·8
1886	11,447	26·4	10,187	40·5
Mean numbers	12,676	29·2	12,359	49·1
1887	10,979	25·3	10,605	42·1

In the above table the mortality of the town is compared with that of the suburbs. In 1887 the town registered 10,979 deaths, giving an annual death-rate of 25·3, while the suburbs registered 10,605 deaths, giving an annual death-rate of 42·3.

Fevers. The fever mortality was the lowest that has been recorded. The number of deaths amounted to 3,253. The mean of the decade was 4,152.

The conditions under which severe continued fevers prevail, and the circumstances which are likely to cause these diseases to assume a typhoidal type, came prominently under observation at a missionary school at Ballygunge.* The school, a two-storied building with rather confined garden space, had been taken and newly occupied some time in September of 1887. Its surroundings were extremely insanitary. On its south side was a bustee containing the ordinary suburban open and foul privies with their contents soaking into, saturating, and polluting the soil. The bustee was undrained and had a very foul pool or tank some 40 or 50 yards away from the school wall. At this south wall a temporary hut had been erected as a schoolroom for the accommodation of the scholars. On the east side of the school was another undrained bustee with a very filthy ditch immediately parallel with the school wall. The boys came to the school in September perfectly healthy, and remained until the Christmas holidays, when they went to their homes. They returned some time in January. Between October and the Christmas holidays, *i.e.*, during the drying up of the rains, there were 48 cases of fever in the school. On the boys' return in January there occurred 32 cases of fever. Altogether, from October to March, there were 82 illnesses, and 53 of the 74 boys in the school, or 71 per cent., suffered from fever, besides two persons, out of a family of five, living with the head master. Some of the boys were attacked more than once, which accounts for the number of illnesses being 82, while only 53 boys were affected. The boys who occupied the schoolroom on the south, adjoining the bustee with its stagnant pool, undrained and saturated ground, and very bad smelling privies, were worst affected, while those who were engaged in the workshop on the north side were least affected.

The cause of this prevalence of fever in the school seems undoubtedly to have been due to the undrained land, insanitary conditions of the surroundings of the school, and to the filthy stagnant pool immediately on the south, from which the prevailing wind blows. In contrast to this extreme unhealthiness was the healthiness of the boys of the older missionary school situated on the opposite side of the road, somewhat nearer

* Ballygunge is a suburb south-east of Calcutta, and situated within the limits of the suburban municipality.

Calcutta. There the land has been well drained, there is plenty of air space, abundance of ground for exercise and recreation, and no cramping of buildings to obstruct free ventilation, there are no filthy, stagnant pools, and the immediate surroundings of the premises of the school have been kept in a fair sanitary condition. Though there was communication between the two schools, no fever attacked the boys of the older school at this time, nor has there ever been known a similar prevalence as noted in the new school. The cause of the continued fever, assuming in some of the boys a severe typhoidal type, may possibly have been due to the sewage-polluted soil. I may here remark that I have observed that European inhabitants residing near undrained bustees are frequently attacked with severe continued fever.

Several deaths occurred from this cause. They do not, however, represent the number of illnesses from typhoid fever which happened in the city, for the disease is one from which there are many more recoveries than deaths. The injury to health, however, which it is apt to leave on those who recover, is often of a permanent nature. Connected with the recent illness from typhoid fever of two well-known young men in Calcutta, one of whom died, a strict inquiry was made, in consequence of a mehter being accused of having thrown night-soil down a certain pipe and thus causing the disease. The investigation cleared the mehter, but brought to light a very defective condition of the drainage of the house. The bath-room pipe was untrapped, and so connected with a foul latrine as to draw up sewer gas into the bedroom. The rain-water pipes were also connected with a cesspit which was in direct communication with the sewer, the summit of which was not far from the house. The house had several other defective connexions with the sewer. Other cases of typhoid fever have come under my observation in Waterloo ward, and on each occasion an investigation discovered defective drainage, and frequently direct communication of the house pipes with the sewer. In one house where two persons were attacked with typhoid fever, an inspection revealed the fact that they had been sitting of an evening over some openings which carried away the rain-water direct into the sewer, and that these openings had in certain conditions of the atmosphere been acting as ventilators for the sewer in the street. It had been customary for the two who were attacked to sit out of an evening in the verandah, which, on several occasions, they had to leave on account of nauseating smells pervading the atmosphere. In other cases of typhoid fever it was found that special ventilators for privies, connected with the sewer, had been placed in unsuitable positions, allowing of sewer gas to be blown into the windows of the house in which the person was attacked. Several cases of illness were directly traceable to this cause. In other instances the absence of traps between house-drains and the sewer were discovered, while in other cases defective gully-pits, not retaining sufficient water to effectually seal their traps, poured forth foul sewer gas close to the windows of dwelling-houses.

The cases of typhoid fever which I have been referring to have been those affecting Europeans, but from inquiries I have made on the subject, the native community do not enjoy an immunity from this disease.

Cholera.

The cholera mortality in 1887 fell below the decennial mean by 435. The number of registered deaths amounted to 1,198 against 1,633, the average number of the decade.

With reference to the prevalence of cholera, the following table is instructive, being information, thrown into a tabular form, acquired by a separate investigation into over 1,800 cases of cholera since my connexion with the Health Department of Calcutta.

Abstract showing Deaths from Cholera in the Town of Calcutta from the 1st *August* 1886 *to the* 31st *March* 1888 *inquired into.*

Section and Wards.			Number of Houses in Calcutta.			Number of Cholera Deaths from August 1886 to March 1888.		Proportion of Cholera Deaths to the 100 of Houses.		Population according to Census of 1876.			Ratio of Cholera Deaths to the 1,000 of estimated Population.			Number of Cholera Deaths inquired into.	Resident in Calcutta for				Number of Cholera Deaths attended by Doctors.	Number of Houses where Deaths occurred in which there were Wells.	Number of Houses close to Tanks.	Number of Houses where there was a Scarcity of Water.	Number of Houses where Deaths occurred which were furnished with Taps.	Number of Houses where Deaths occurred, and Drainage choked up.	Number of imported Cases.	Percentage of Tanks close to Houses affected on the Total Number of Cholera Deaths inquired into.
Number.	Police Sections.	Name of Ward.	Kutcha.	Pucca.	Total.	Kutcha.	Pucca.	Kutcha.	Pucca.	Kutcha.	Pucca.	Total.	Kutcha.	Pucca.	Total.		A Week and under a Week.	Over a Week and under a Month.	Over a Month and under a Year.	Over a Year.								
1	A	Shampooker	2,216	1,283	3,499	75	35	3·3	2·7	13,590	10,941	24,531	5·5	3·1	4·7	111	11	4	16	80	78	23	66	21	2	19	3	59
2	B	Coomertooly	1,774	1,434	3,208	99	42	5·6	2·9	16,812	15,670	32,482	5·8	2·6	4·5	141	17	18	39	67	89	66	12	87	3	11	4	9
3	C	Burtollah	2,006	1,282	3,288	79	28	3·9	2·2	12,979	12,188	25,167	6·0	2·2	4·2	107	8	2	26	71	75	19	54	37	7	16	4	50
4	D	Sukeas Street	1,779	845	2,624	75	19	4·2	2·2	11,198	8,917	20,115	6·6	2·1	4·6	94	13	3	13	65	66	6	58	23	5	7	3	62
5	E	Jorabagan	1,792	1,639	3,431	127	87	7·0	5·3	14,924	22,381	37,305	8·5	3·8	6·0	214	27	25	49	113	128	96	4	64	13	15	6	2
6	F	Jorasanko	1,945	1,540	3,485	135	57	6·4	3·2	18,039	16,356	24,395	7·4	3·1	4·9	192	16	9	45	122	57	54	39	48	8	8	2	20
7	G	Burra Bazar	396	1,107	1,503	58	72	14·6	6·8	6,330	16,108	22,438	9·1	4·4	5·7	130	18	15	44	53	80	47	—	47	6	15	6	—
8	H	Colootollah	2,072	1,294	3,366	226	34	10·9	2·6	32,867	15,635	48,502	6·8	3·3	5·4	260	23	24	37	176	112	75	3	100	21	17	7	1
9	I	Moocheepara	2,371	1,639	4,010	146	28	6·1	1·7	21,572	15,855	37,427	6·7	1·8	5·2	174	21	9	22	122	78	30	45	55	12	11	5	26
10	J	Bow Bazar	742	942	1,684	37	17	4·9	1·8	12,111	10,365	22,476	3·0	1·6	2·5	54	10	2	13	29	20	11	—	15	4	2	2	—
11	K	Puddopooker	864	1,076	1,940	62	36	7·1	3·0	8,727	10,830	19,557	7·1	3·3	5·1	98	16	5	16	61	54	26	1	17	16	6	3	1
12	L	Waterloo Street	19	430	449	—	7	—	1·5	123	5,322	5,454	—	1·3	1·4	7	—	1	2	4	3	—	—	1	—	—	—	—
13	M	Fenwick Bazar	1,259	880	2,139	82	10	6·5	1·1	16,369	9,204	25,573	5·0	1·1	3·7	92	6	5	30	51	33	13	1	3	11	6	1	1
14	N	Taltollah	1,805	812	2,617	83	11	4·6	1·3	19,761	6,122	25,883	4·2	1·7	4·2	94	8	2	11	67	44	9	2	14	7	8	2	2
15	O	Colinga	870	368	1,238	43	3	4·9	0·8	8,175	4,019	12,194	5·2	0·7	3·8	46	2	2	7	35	8	3	13	5	1	2	1	28
16	P	Park Street	152	154	306	12	5	7·8	3·2	843	3,515	4,358	14·2	1·4	4·1	17	3	1	3	10	5	1	7	—	—	—	—	41
17	Q	Bamun Bustee	280	98	378	23	1	8·9	1·0	3,049	3,220	6,269	7·5	0·3	3·8	24	2	1	4	17	9	—	17	1	—	2	1	71
18	R	Hastings	518	73	591	11	1	2·1	0·5	4,264	655	4,919	4·5	1·5	2·6	12	1	—	1	10	1	—	2	—	—	—	1	16*
		Total	22,860	16,896	39,756	1,373	493	6·0	2·9	221,733	187,303	419,036	6·1	2·6	4·4	1,867	202	128	384	1,153	940	479	324	448	116	145	51	17

* Skirts the banks of Tollys Nullah.

Number of houses in Calcutta according to Census of 1881 { Pucca - - 20,667 / Kutcha - 18,107.

The results are given ward by ward, and include the following details, viz., the number of deaths which have occurred in hut and brick building, the length of time the patient had been in Calcutta, and the number attended by qualified medical men, the number of infected houses with wells, the number of infected houses found close to tanks, the number of houses in which a scarcity of water was noted, the number which were provided with tap water, the number in which the drainage was choked, &c.

No ward census of huts and houses having been taken in 1881 for this information, I have had to fall back on the census of 1876, consequently the figures representing the number of houses and huts and their population are not so approximately correct as one would wish; but for the past few years the general tendency has been a diminution in the number of huts and an increase in the number of brick buildings, so that the relative proportion of hut to brick house, as presented in the table, is rather over-estimated than the reverse, the brick buildings being fewer then than now, while the huts are fewer now than then. The present population living in brick and hut houses differs in numbers from that in 1876. The dwellers in kutcha houses are in the table over-estimated, while the dwellers in pucca houses are under-estimated. This explanation as regards the figures employed will show that the differences of cholera incidence on hut and brick building actually brought out are less intense than they would be if the figures of to-day could be obtained.

The total number of cases inquired into was 1,866; of these 1,373, or 72 per cent., were among dwellers in huts, and 493, or 28 per cent., among dwellers in brick buildings.

The proportion of cholera deaths to 100 houses of each kind was—*

Kutcha	6·0
Pucca	2·9

While the ratio of cholera deaths to 1,000 of the estimated population in each kind of house was—

Kutcha	6·1
Pucca	2·6

that is, considered by the number of houses, the hut-dwellers suffer more than twice as much as dwellers in brick houses; whereas, considered by the number of people living in each kind of house, it appears that the hut dwellers suffer nearly three times as much from cholera as the dwellers in brick houses.

As will be observed from the table, the ratios differ considerably in different wards, but it is always among the hut-dwellers that the highest mortality is shown. Another point in the table is that 330 out of the 1,867, or 17 per cent., were attacked with cholera within a month of their arrival in Calcutta. In some wards, such as Jorabagan and Burrabazar, 24 and 25 per cent. of the deaths were persons who had not been over a month in the wards. It will also be noted that a large percentage of the infected houses in Coomertolly, Jorabagan, and Colootollah were provided with well water, and that the wards provided with the largest number of wells correspond very fairly with the wards in which the greatest scarcity of water was observed. Shampooker Burtolla, Sukea's Street, Jorasanko, Moochepara, Collinga, and Bamun Bustee wards had a large proportion of their cases in houses close to tanks. Shampooker ward had as many as 59 per cent., Sukea's Street ward 62 per cent., and Bamun Bustee ward 71 per cent.

In these investigations the one fact which prominently obtruded itself was the scarcity of water, and on account of this the necessity on the part of the inhabitants to have to resort to well water, tank water, or if near the river, to river water. Of course, in many instances where a tank was near, it was not always scarcity of water which caused the inhabitants to resort to the tank. The subjoined calculations of the engineer in explanation of deficient pressure confirm what has thus been ascertained

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* By the census of 1881 { Kutcha 7·5 / Pucca 2·3

by direct inquiry as to the scarcity of water among the poor, who are the inhabitants of huts and low-rented brick buildings :—

Annual Value of Premises.	Diameter of Ferrule.	$G = \sqrt{H} \times d^2 \times 9$ Discharge through Ferrules with House-pipe attached, per Minute.		Number of Ferrules sanctioned up to 31st December 1887.	Discharge of all Ferrules working simultaneously.			
					Per Minute.		Per Hour.	
		At 10 Feet Pressure.	At 30 Feet Pressure.		At 10 Feet Pressure.	At 30 Feet Pressure.	At 10 Feet Pressure.	At 30 Feet Pressure.
Rs. Rs.		Gallons.	Gallons.		Gallons.	Gallons.	Gallons.	Gallons.
1 to 59 -	$\frac{1}{8}$-inch	·44	·77	569	250·36	438·13	15,021	26,287
60 to 119 -	$\frac{1}{4}$ „	1·20	3·88	2,722	3,260·40	8,383·76	195,984	503,025
120 to 599 -	$\frac{3}{8}$ „	4·00	6·93	8,119	32,476·00	56,264·67	1,894,560	3,375,880
600 to 1,199 -	$\frac{1}{2}$ „	7·11	12·32	1,719	12,222·09	21,178·08	733,025	1,270,684
1,200 to 2,390 -	$\frac{5}{8}$ „	11·11	19·25	716	7,954·76	13,783·00	477,285	826,980
2,400 to 3,599 -	$\frac{3}{4}$ „	16·00	27·72	508	8,128·00	14,081·76	487,680	844,905
Above 3,600 -	1 „	28·44	49·28	378	10,750·32	18,627·84	645,019	1,117,670
	$1\frac{1}{4}$ „	44·44	77·00	10	444·40	770·00	26,664	46,200
	$1\frac{1}{2}$ „	64·00	108·88	9	576·00	979·92	34,560	58,795
Standposts - -	Same as $\frac{1}{8}$-inch	7·11	12·32	529	3,767·19	6,517·28	225,671	391,036
				Total -	79,829·52	141,024·44	4,789,769	8,461,462

"In other words, these figures show that the draught through the ferrules at the command of consumers amounts to three times what the total of the extended engine power can supply. The average pressure that would obtain over the district supplied under such circumstances is ascertained by the following expression $3\sqrt{-H} = \sqrt{30}$, or $H = 3{\cdot}33$ feet.

"Of course it never happens that all ferrules are working simultaneously, but I am of opinion from observation that, under existing conditions during the hours of high pressure, three-fifths of the ferrules are working simultaneously. This means that the probable ferrule draught, with the present scale of ferrules, would be 5,000,000 gallons an hour against an engine power of little more than half that capacity. While the consumers are exerting a power to draw off at a faster rate than the engines can supply, it is impossible that a pressure of 30 feet can be enjoyed.

"Then from the engine point of view, the extended power, working without any standbye, is capable of distributing the whole day's supply of 16,000,000 gallons in six hours, but the people must have water available at any time during the 12 hours of day. So that draught must in some way be limited to what the engines can supply, that is, to 2,604,784 gallons per hour, and for a fewer number of hours than six for high pressure, in order to have sufficient to spread over the remaining hours of the day for low pressure."

The table shows at a glance the unequal distribution of the water-supply and verifies the statement I made in the Annual Report of 1886, concerning the large quantity used by a section of the upper and middle classes in their houses, and the small quantity left for the poorer classes and others. I use the table to show what a small quantity of water the hut-dwellers really obtain, for it is they who receive their chief supply from the standposts, and it is they who form a very large proportion of the population. From this table it is seen that if it were possible for all the standposts to be kept open throughout the day, and for them to run full throughout the six hours during which the engines usually work at full pressure, they could not supply much more than 2,000,000 gallons of water in that time, or four in the 12 hours. The actual amount from the standposts, however, is supposed to be nearer 800,000 gallons a day, which supplying 200,000 people, gives them about four gallons per head. In some quarters even this quantity is not obtained. True, some of the hut-dwellers are allowed to take water from their rich neighbours who have water-pipe connexion in their houses, while a few of the hut-dwellers have taps on their own premises, but the number is so limited as not to interfere with the calculation that supposing the hut population of Calcutta went only to the standposts, they could obtain at the most about five gallons a head per day. It might even be estimated at less, for there are a number of standposts from which the water flows with very little force, and others from which water is obtainable only for an hour or two. The result of all this is that the poorer people, the inhabitants of the bustees and of the low-rented brick houses, get a less quantity of water than they previously did when the supply was first introduced, though the actual supply for the town was much less then than it is now. Water

could then be obtained at any hour of the day or night from the standposts; later on, the supply could be obtained during 12 hours of the day from the standposts, and the time has gradually come to be curtailed in many parts of the town to four hours in the morning and two hours in the afternoon. The influence of that limited supply may well count as an important factor among others in the greater prevalence of cholera among the inhabitants of huts when compared with that prevalence among the inhabitants of brick houses.

To remedy this it is proposed, when the new water-supply is introduced, to have 800 standposts in place of 539. It would be more, I believe, fitting the requirements of the town if there were four or five thousand new standposts. More standposts, fewer household connexions, and a constant supply in place of an intermittent supply, would help considerably to lessen the waste which now goes on, as well as the dangers from contamination which an intermittent supply is liable to; while at the same time it would give the poorer class of inhabitants a sufficient supply whenever they wanted it. There should be in each bustee a proportionate number of standposts according to its population; it would also be of much advantage if each standpost had three or four taps to draw water from.

A factor in the dissemination of cholera, bringing it among people who dwell amidst fair sanitary conditions, appears to be a contaminated milk supply. Consequently the sanitary condition of cowsheds thereby acquires a new importance, and the urgency of a plentiful supply of pure water to them becomes apparent. Watering of milk by gowalas (milkmen) is too much a time-honoured custom to be readily checked. It is therefore of the highest importance that the only water accessible, either for dilution of the milk or washing of the milk utensils, should be above suspicion. In the sanitary condition of the cowshed the first and foremost improvement is accordingly to be obtained by supplying all cowsheds with pure filtered water, and compulsorily closing all wells on the premises. The cow-keeper who has a liberal and plentiful supply of filtered water on his premises will be less likely to use tank or well water, even should there be a tank or well at no great distance from his cowshed.

Bowel complaints.

Deaths from dysentery and diarrhœa numbered 1,197 in 1887, against a decennial mean of 1,485. The highest mortality was in the cold months; the lowest in May.

Small-pox.

During the year 1887, Calcutta enjoyed unusual and unprecedented immunity from small-pox, there being only two deaths in 12 months. This is the smallest number ever recorded in Calcutta since 1833, from which year statistics are available. From September 1886 to April 1887, the town was entirely free from the disease. After this long respite, a case occurred for the first time in Burtollah Section. The Deputy Superintendent, during the course of his inspection of home vaccinations, got information of it on the 9th May 1887. The patient was a prostitute residing at No. 18, Durga Churn Mitter's Street. She was a native of Midnapur, and was vaccinated there in her infancy. She fell a victim to the disease. Almost simultaneously with this case, six other cases occurred in the different sections of the town, viz., one, Sukea's Street, two, Jorasanko, two in Moochipara, and a pilgrim, who had no fixed residence.

From June to December there was not a single case of the disease in the town.

In the beginning of the cold weather, the disease was as usual imported into the town. The S.S. "Thisbi" arrived in port on the 3rd of October 1887, with pilgrims from Jedda, among whom there were two cases of small-pox, and on the 18th November 1887, the S.S. "Medussa" also arrived in port with nine cases of small-pox on board. These vessels were detained below Garden Reach, the infected crew sent to hospital and the rest re-vaccinated. The vessels were disinfected at the same time. Fortunately, these imported cases did not help to spread the disease in the town.

On receipt of information of these small-pox cases, the usual precautions were taken, viz., thorough search was made in the neighbourhood of these centres of contagion, and all persons found unprotected, mostly children under one year, were vaccinated at once. A large number of persons were re-vaccinated at the same time. The beddings and clothings of the infected were destroyed under supervision, and the houses in which the cases occurred were fumigated and disinfected. These precautions seemed sufficient to control the disease and to prevent its further spread.

Other causes.

The deaths from causes other than those included under the distinctive heads of cholera, bowel-complaints, fevers, and small-pox, amounted to 5,329 against a decennial mean of 5,073.

Vaccination. The total number vaccinated during the year 1887 amounted to 10,547. Of these 9,616 were primary, and 931 were re-vaccinations. The corresponding figures of the previous year were 9,971 and 1,367, respectively. This shows a decrease of 355 primary and 436 re-vaccinations. This decrease occurred in the first quarter of the year, and is to be attributed to the indifference of the people to get their children vaccinated owing to total absence of small-pox.

Of the total primary vaccinations, viz., 9,616, 8,371 were successful, 355 were unsuccessful, and in 890 cases the result was unascertained. The rate of success, calculated on the ascertained successful cases, was 87·05. Of the 931 re-vaccination, 98 were successful, 652 were unsuccessful, and the result of 181 cases was not ascertained. The rate of success in re-vaccinations was 10·52. The rate of success in primary and re-vaccinations last year were 91·83 and 15·06. The falling-off of successful cases in primary vaccination was due to the result of a larger number of cases not being ascertained. The operations with humanised lymph was less satisfactory this year than usual. The result in a large number of cases proving doubtful.

Vaccination is systematically carried on in all the sections of the town; but the degree of protection of each ward varies with the nature of its population. The sections or wards inhabited by the Europeans (as the Park Street), and the resident Bengalees (as the Sukea's Street, Shampooker &c.), are better protected than those in which the population is chiefly floating, and the residents comprised of up-country people.

The compulsory Vaccination Act has very materially helped to carry on vaccination amongst the lower classes of these up-country people, but the better classes still manage to evade the law in various ways.

In the first place, they do not invariably register the birth of their children, and those who do so do not get their children vaccinated, and when the registrars submit their names as defaulters, and inquiry is made with a view to prosecute them, they cannot in most cases be traced out. A number of these up-country men live in one house and when an unprotected child is found by the vaccinators, no one will give the name of its parents or guardians. Where the name of the parents is obtained, the notices or summons cannot be served, as the parties cannot be identified. Owing to this difficulty repeated applications for summons had to be made against some individuals, but without effect. Instances are not wanting where people have changed abode or even left town on receipt of notices for vaccination or of summons from the Court to avoid vaccination.

In Calcutta both the humanised and animal virus was kept up by regular transmission and used all the year round. The success of the humanised lymph was less satisfactory than usual, a large number of cases proving doubtful during the hot weather and rains. The success of the operations with bovine lymph was as usual, but it was considerably less than that of the humanised virus.

The Vaccination Act was carried out more rigorously in the year under report than that preceding it. It was found necessary to do so to overcome the indifference or negligence of the people usual in a non-epidemic year. The registrars of births submitted by monthly statements the name of 5,854 persons who failed to produce the statutory certificates of having had their children vaccinated. These cases were all inquired into by the department with the following results:—3,567 were traced and vaccinated, 938 were found to have left town or changed abode, 256 could not be traced, 280 were dead, 429 were ill, and 384 were prosecuted, and with the exception of those who produced medical certificates or left town before the day of trial, were vaccinated by order of the magistrates. Besides the above prosecutions, 695 were prosecuted for disregarding the notices served on them departmentally, and 358 for neglect of inspections, so that the number of prosecutions under all heads amounted to 1,437. The number prosecuted last year was 1,279.

Notwithstanding the larger powers of vaccination and inspection conferred by this amended Act, great difficulty is still experienced in its practical working. The lower orders of the people in the bustees or villages are and have all along been accessible to the vaccinators. Information of unprotected persons amongst them is easily obtained, and those who refuse vaccination at the instance of the vaccinators are compelled by law to submit to it. It was difficult to obtain such information amongst the better classes. Vaccinators were not allowed to enter private houses and examine persons with a view to find out the unprotected. It was to facilitate the receipt of this information that the amendment in the law was asked for. But the difficulty to obtain such information still prevails amongst the better classes of the up-country people. A large number of these men live in one house, and although vaccinators can now

enter a private house and find out unprotected children, it is almost impossible to get the name of their parents or guardians. When asked whose children these are, they invariably reply—"They don't know." Where the name is obtained, the parties cannot be identified, and no one will come forward to receive a notice or a summons, so that the practical help of the amendment has been hitherto *nil.* It may not be out of place to mention here that vaccinators have been carefully instructed not to enter a private house without due notice, and in the absence of some responsible male member, and where the examination by a male vaccinator is refused, the services of the female vaccinator are invariably utilised. She is also employed not only in vaccinating and re-vaccinating grown up females in the respectable Hindoo and Mahomedan zenanas, but to examine them in case of doubtful protection.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1887-88.

(*Lieut.-Colonel G. M. J. Moore, President.*)

Drainage.

Drainage.—The remaining portion of sewer No. 1 was undertaken in April 1887, and was completed in June, the length laid consisting of 946 feet of 18 inch stoneware pipes. The work was of a somewhat delicate nature, as the sewer passed through the narrowest portion of Popham's Broadway, where high buildings, such as those of Messrs. Oakes and Co., the Bank of Madras, &c., line the street; the work was completed without the slightest damage of any kind to these buildings. Much anxiety had been felt in regard to this work, but fortunately no rain fell during the period of its execution. This work practically completed the sewers themselves though several overflows and junctions remain to be done, nor can the sewer be used until a great portion of the surface drainage of that portion of the city to the west of the Broadway is completed.

Towards the end of the year at the south end of the Broadway it was necessary to lay two outfall drains, and in order to do so the 21-inch water main had to be lowered by about 4 feet. This operation was successfully completed, and allowed of the lowering of China Bazaar Road, which itself was much above the level of Broadway, and tended to flood that street by preventing the escape of storm water until the level of the former street was reached. The improvement effected will prevent water standing so long in the Broadway some 2 feet deep, as it formerly used to do on occasions of heavy rainfall.

Surface Drainage.—In connexion with this one large work, viz., that of widening Audiappa Naick Street, made good progress throughout the year. The properties along this street were taken up under the powers given by the Land Acquisition Act. The street for a length of 1,325 feet has been realised, and about 1·42 grounds of land have been added to the street, which now has a breadth of 40 feet against a previous average breadth of 35 feet, though in some places before the improvement the width was so little as 20 feet. The improvement is very great, but the expenditure has been in proportion, having amounted to Rs. 36,284-10-3, all of which was disbursed during the year.

The plans for widening two portions of Mint Street and Anna Pillay Street were under preparation, and for one portion of Mint Street Government were asked to sanction the acquisition of the land required.

A large amount of work has been done in connexion with the surface drainage; 90,823 feet of all sizes of drains were constructed, as compared with 51,642 feet in the previous year.

Only two more contracts require to be allotted to complete the remainder of Black Town, and the necessary plans, specifications, and schedules for these are ready.

Some inconvenience is at present felt owing to the strainers in the drains getting blocked during the night by solid matter, which are continually thrown into the drains, such as cocoanuts, plantain leaves, and leaf plates, and only lately a dead dog got into a drain crossing under a roadway. Devices are being considered by which this solid matter may be withdrawn from the drain before arriving at the sewer inlets. This nuisance is chiefly in that portion of the town inhabited by the lower classes of the population, who evince no desire to keep the drains clear of such matters, and even when they find a drain blocked to their own inconvenience, take no trouble to remove the obstruction.

House Drainage.—During the year Rs. 615-0-7 were paid to contractor for the execution of house drains which the owners failed to alter and repair after notice, and Rs. 1,669-6-3 on the same account were received from house owners. The number of house drains altered and repaired by the municipality during the year was 358 and by the owners 1,329. This makes a total to date of 6,657 house drains altered and repaired since the drainage works began.

During the year plans and sections for the drainage of a portion of Mylapore were prepared. A rough estimate was also made showing that the cost would be about Rs. 2,00,000, but the municipality would save a large sum by the abolition of the sewage carts now carrying sewage from the numerous cesspools with which Mylapore abounds. The drainage of Mylapore is certainly a most pressing need.

The sewage trough referred to in last year's report as required to complete the Triplicane works was erected across the Buckingham Canal during the year. It also forms a foot bridge which leads from the farm to Vencata Runga Pillay Street, a much needed municipal communication.

Water supply.

The distress caused by a very much reduced water-supply led Mr. J. A. Jones, Vice-President Public Works, to suggest means to proceed with the new water-supply scheme for improving the water-supply of the city both in quantity and quality without placing a very great burden on the municipal finances, the Government having expressed their inability to help in its furtherance. The suggestion was to use the amount of money already sunk towards the liquidation of the Waterworks Loan of 1869–73 to begin the scheme. A committee was appointed by the Commissioners, as requested by Mr. Jones, to consider any feasible scheme for the improvement of the existing water-supply. The committee submitted their report, which was considered by the Commissioners a ta special meeting in April 1888. The result of this meeting will find place in the report for 1888–89.

At the beginning of the year the level of the Red Hills Lake was only 6 feet above the bottom of the delivery channel and 3 feet 6 inches above the necessary level of the surface of the water in that channel. On the 31st May it had fallen almost to the level of the water in the channel. Pumping was then begun and continued up to 14th October when the water rose to 4 feet 3 inches above the level of the bottom of the channel. The level of the bottom of the channel at the offtake is 31·31 above mean sea level, and of the surface of the water in the channel 33·81. The lowest level to which the lake fell was 31·76 on the 6th September 1887, or slightly above the level of the bottom of the channel. The cost of the pumping, including the transfer of engines, their return to stores, and repairs, was Rs. 23,364-9-5.

The quantity of water supplied to the city during 1887–88 (277,061,501 cubic feet) was, because the larger portion of it had to be pumped, about 35,000,000 cubic feet less than the supply in the preceding year. Even when the supply was direct the consumption was less than in the preceding year, when the consumption was about 18 gallons per head by an estimated population of 300,000 within the water-supply area. This year the consumption has been 16 gallons on the average, but it is likely that had more water been obtainable during the hot months, that the amount would have been even greater than 18 gallons. This deserves particular attention, because it shows that the consumption has increased mostly beyond what was anticipated. A small percentage is due to the use of the water for irrigational or mechanical purposes.

Conservancy.

During the year under review, the labour, bullocks, and carts continued to be supplied by contractors. The labour and bullocks of 1st, 2nd, and 3rd divisions were supplied by one contractor, 4th by another, and 8th by a third contractor. The carts for the whole of the eight divisions are supplied by one contractor. During the year 45 new carts were supplied. The general condition of conservancy carts is a great deal better than it was a couple of years ago, but still there is considerable room for improvement. There are constant complaints from the contractor for supply of carts that his carts are being wantonly damaged by the drivers, who are supplied by a different contractor; whether wilfully or through sheer carelessness, the carts are not as well taken care of now as they would be if the cart contractor's own men drove his carts. Only the night-soil and the cesspool carts are owned by the municipality and the rest supplied by contractor. The total cost of labour, bullocks, and carts amounts to Rs. 1,86,114-3-9 as against Rs. 1,78,959-4-6 in 1886–87. The excess is partly due to a slight increase in the conservancy staff and partly to a higher rate for labour under the new contract.

In Bombay provision has to be made for the conservancy of 7,73,000 persons scattered over an area of 22 square miles, and in Calcutta for 4,29,000 occupying six square miles, whereas in Madras arrangements have to be made for a population of 3,97,626 scattered over an area of nearly 27 square miles: and further, no water system has been in operation for the removal of night-soil: the removal has been

by manual labour. The actual expenditure for the conservancy of the city was Rs. 3,35,425.

About the end of January 1888 a form of cattle disease, which was subsequently diagnosed as rinderpest, broke out among the conservancy bullocks located in the Kishnampett bullock depôt; soon after the outbreak became known application was made to the inspector of cattle-diseases for the services of one versed in veterinary science, but the inspector of cattle diseases expressed his inability to lend the services of any subordinate of the Veterinary Department to look after the cattle. The diseased cattle were removed to a temporary pound, and every attention was paid to segregation. About 41 were admitted into this pound, of which 15 died, the rest recovered and were sent back to their work; the disease continued to prevail at one depôt or another of the south range till the close of the official year 1887–88. The Board of Revenue did, about the middle of February, give the services of a local cattle disease inspector, but as the disease showed no signs of assuming a virulent type, the inspector was ordered to go back to his work in Trichinopoly from 3rd March. But for the immediate segregation and institution of timely treatment, and adoption of all precautionary measures, the disease would no doubt have spread. It seemed difficult to trace out the origin of the disease in the Kishnampett depôt, and the local cattle disease inspector writes as follows in his report of 23rd February 1888:—

"How the recent outbreak of rinderpest was localised in Kishnampett can only be explained by the inference that some of the cattle of the depôt, having been taken to places where rinderpest contagion should have existed, may have contracted the disease under bad sanitary conditions favourable for the development of the disease, and these in their turn should have communicated the contagion to some of the beasts along whom they were lodged. Segregation and timely treatment have both acted favourably in arresting the disease; not having spread outside the depôt is also due to the same cause."

The difficulties the Health Department have to contend against to maintain anything like a satisfactory system of conservancy have been dealt with in previous reports and explained in full. To begin with, the supply of labour is insufficient, and under the contract system, though the contractor is paid Rs. 5-10-0 per head, the supply is very irregular, and the coolies are so ill-paid by the contractors that they are driven to do private work, and thus neglect the municipal work.

The scavengers, as a class, are no doubt very difficult to deal with; their unruly temper, the strong spirit of trade-unionism that exists among them, and the fact of the scavengering work being undertaken by only this class of men, all combined often act as a strong deterrent force against any progress being made in conservancy work. If the municipality undertake the private scavengering of a few houses, they at once imagine that their rights are being invaded upon, and there is a general strike among the coolies; if the police arrest a few for throwing night-soil into open carts, where there are separate covered carts provided for removal of night-soil, there is a general strike; what the consequence would be when scavengers, public and private, refuse to work need hardly be described. Till there are other classes of men to compete for conservancy work with scavengers, refusal of work should be penal, but before an enactment of this kind could be instituted, care should be taken to see that the wages allowed are commensurate with labour. As has been already pointed out, the contractor is paid on an average about Rs. 5-10-0 per mensem for every man cooly supplied. The nominal wages of a man, as paid by contractor, is Rs. 5, but it is seldom that a cooly receives more than Rs. 3 per mensem. It is not attempted to defend the scavengers, but the fact is they are very badly paid and badly treated under the contract system. The contractor pays the cooly, and the municipal overseer takes work from him, and the man has to serve two masters, but, of course, his strong leaning would be towards the master that pays him his wages. Passing on to the class of people for whom conservancy arrangements have to be provided for, it must be remarked that with the great body there are very many insanitary habits in vogue of long standing which are considered perfectly innocent by them. For instance, a man who is much distressed about the non-removal of a few dried leaves or a small quantity of ashes from the dustbin near his house, would allow his children to commit nuisance over the drain adjoining the pial of his house or into the dustbin itself; children during day time, and grown-up men during nights, freely commit nuisance in streets and lanes. There are hours fixed for carts to pass round streets, but there is no time fixed for deposit of rubbish in streets; the streets continue to be fouled throughout the day and nights, and every sort of thing finds it way to surface drains.

The co-operation of the public is very much needed in matters of public hygeine; the sanitary requirements may no doubt be enforced by an appeal to magistracy, but staff would be necessary for detection. The Health Department do not wish to harass people unnecessarily, but it has to be borne in mind that an infringement of a sanitary law by an individual may seriously jeopardise the health of the locality; the consequences being so serious, what is the penalty imposed? For the first time the party is warned, or a nominal fine of annas 2 or 4 imposed. Light punishment, such as this, is not likely to prevent people from committing the offence, especially when the chances of being apprehended are so few.

Vaccination.

The total number of cases vaccinated during the year 1887–88 was 20,037, as against 20,270 in 1886–87. Of these 19,170 proved successful, against 19,220; 388 unsuccessful, against 450, and the results in 479 cases were not known. The percentage of successful cases during the year was 95·6 as against 94·8 in 1886–87, and it is gratifying to note, while there has been an increase in the proportion of cases vaccinated successfully, there has been a decided fall both in the number of cases that proved unsuccessful and in the number of cases the results of which could not be traced. The total number of 20,037 cases vaccinated include 18,523 cases of primary vaccination, and 1,514 of re-vaccination. As hitherto, the percentage of successful vaccination among cases of primary vaccination (96·89) was higher than among cases of re-vaccination (80·77).

Out of 20,037 cases vaccinated, 13,668 were among children not exceeding one year, 3,663 between one and six years, and the remaining 2,706 above six years. Of the 13,668 children under one year vaccinated during the year, 10,140 were reported to have been born in Madras, and the remaining 3,528, though of parents permanently residing in Madras, were born not in Madras, but in moffusil stations.

There is little room for doubt that almost all the children in the city are vaccinated before they are a year old, and the compulsory vaccination has been worked so as to cause as little hardship as possible to the public. Every endeavour was made to prevent people looking upon vaccination as a legalised form of tyranny. The fishermen of Royapuram still continue to resist, but during the year under review a few of their children were vaccinated, and it is hoped that soon they will see and appreciate the inestimable advantages of vaccination. It was remarked in last year's report that during 1885–86, for 38,589 cases vaccinated, only 545 summonses were taken out, but during 1886–87, for only 20,270 cases, 2,219 summonses were taken out, and again there was no occasion for the magistrate to impose a penalty. During the year under review no less than 3,199 summonses had to be taken out for parents or guardians of unprotected children to show cause why they should not be vaccinated, and here, again, there was no occasion for the magistrate to levy a fine, as the parties either got their children vaccinated or gave satisfactory explanation for not doing so. 1,807 postponement certificates had to be granted, against 1,933 in the previous year.

Distributing the cases vaccinated under the different classes of population, it is found that a larger percentage of Hindus are vaccinated than any other classes. Every effort is being made to vaccinate not only children but grown up people, because to prevent small-pox, the whole population has to be brought under the influence of vaccination. In this connexion it may be remarked that during the year there were 27 deaths from small-pox, and most of these were imported from mofussil stations. For Madras to enjoy anything like perfect immunity from small-pox, the surrounding districts, more especially the adjoining district of Chingleput, require to be as well protected as Madras. Vaccination can by no means be satisfactory in a place where it is not made compulsory by a legislative enactment, and considering the way in which compulsory vaccination has been worked in Madras, and how comparatively easily the people have taken to it, there seems little room for doubt that compulsory vaccination could be introduced with equal success into other parts of the Madras Presidency.

The cost of each case vaccinated amounted to annas 10 and pie 1, and that of each successful case is annas 10 and pies 6, against annas 10 and pies 8 in 1886–87. The average cost of each successful vaccination conducted in Madras is less than that of the previous year by 2 pies. It does not appear possible to effect any reduction so long as vaccination is carried on direct from calves in six depôts for six days a week. If, perhaps, vaccination be done only three days a week, some saving may be effected, and it does not seem likely the people will be put to any inconvenience thereby, and the vaccinators will have more time at their disposal to go about their division.

It is only by the vaccinators going about their division the work in the depôt can be materially increased. Tracing out births after an expiry of six months is by no means an easy task.

The Vaccination Department has to contend against prejudices, long-standing and deep-rooted, in a class of people who are highly sensitive, more especially in religious matters; an attack of small-pox is attributed to the Goddess Mariammon, and such secrecy is observed when there is a case of small-pox, that not seldom information is received only after a fatal termination. There is a strong aversion to anyone seeing a patient attacked with small-pox, and in many instances much difficulty is experienced in obtaining admission into a house in which a case is said to exist. But it is hoped that the prejudices will gradually die out as the beneficial effects become more generally recognised.

Vital statistics.

Births.—Inclusive of still-born there were 16,688 births reported during the year 1887 as against 15,976 births in 1886, and 15,989, the average of 10 previous years. Exclusive of still-born cases there were 16,287 births, giving an annual ratio of 40·8 per 1,000 of population against 15,720 in 1886, giving an annual ratio of 39·4 per 1,000 of population, but inclusive of still-births the birth-rate for the year is 41·8 as against 40·0 in 1886.

Of the total births reported 8,593 were males and 8,095 females, that is, during the year there were 106·1 male births to 100 female births. As it was stated in the previous year's report, in Madras male births exceed female births. During the year there have been 401 still-born cases reported as against 256 in the previous year. The proportionate number of still-births reported in the Mahomedan community has been much higher than in any other class of people, and the causes for the same were explained in the report of 1886. The conditions under which Mahomedan women are placed and the circumstances by which they are surrounded are eminently calculated to tend to the production of such results.

It may be stated with confidence that hardly any birth escapes the notice of the Registration Department, and the uniformity of results shown as regards birth-rate among the different classes of people, proportion of male to female births, and, to a certain extent, the variation in the number of births reported month after month, place it beyond doubt that the registration of births is accurate, and that no fictitious cases are included in the returns. There is some difficulty experienced in getting parties to register cases of births, especially among the uneducated classes. This difficulty is particularly experienced among the fishermen of Royapuram, but not seldom even educated people who should know the value of registration refuse to register cases till they are threatened with prosecution. They imagine that the information they give to Conicapillays when they go about to search after births should suffice.

Mortality.—During the year there were 16,192 deaths reported, inclusive of still-births, as against 14,699 in 1886. The death-rate in the year 1887 was 40·6 as against 36·8 in 1886 and 39·7, the average of 10 previous years, but if the still-births be excluded then there were 15,791 deaths in 1887, giving an annual ratio of 39·8 per 1,000 of population. The following is a statement of deaths from the most prevalent diseases during the year as compared with those of 1886:—

Years.	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.	Total.	Other causes.	General Total.	Ratio per 1,000.
1886 - - -	1	250	3,801	2,586	4	6,642	8,057	14,699	36·8
1887 - -	13	73	4,037	2,911	530	7,564	8,628	16,192	40·6
Average of 10 previous years.	1,069·2	116·3	3,639·6	2,512·9	436·4	7,774·4	8,092·2	1,586·6	39·7

Excepting from measles, deaths from every other cause appear to have been higher in the year than in the previous year of 1886.

Small-pox.—Of the 13 deaths from small-pox, 3 occurred in April, 1 in May, 2 in July, 2 in September, 2 in October, 2 in November, and 1 in December of 1887.

Cholera.—There were, during the year under review, 530 deaths from cholera. There have been two distinct outbreaks: the first was about the commencement of the year, principally confined to the 1st and 3rd divisions, and the second outbreak commenced about the last week of July and continued to prevail till the end of the year. During the first outbreak the disease was principally confined to Vanniers, a sect of the Hindus, in the 1st division, and to Mahomedans in the 3rd division, and the disease was so far localised that it was not considered to prevail in an epidemic form. The first case in the 3rd division, occurred in a house in Ungappah Naick Street, on the 12th March, which subsequently proved to be a centre of infection, the inmates of the house were induced to vacate the house, and the house was thoroughly disinfected, when the disease subsided. There were three cases in April and one in May, and these were of a sporadic character. During the whole of June there was no case of cholera in any of the eight divisions of Madras, and in July, excepting the case of one Mr. Gordon, residing in Condy Chetty Street, Black Town, who was reported to have been attacked on the 7th of July, there was no case till the last week of July, from which period the second outbreak may be said to have commenced.

Cholera prevailed in Madras for 9 out of the 12 months of the year, and it is to be noted that the several divisions have not suffered equally, nor have the different classes of people been equally attacked during the year. Among Mahomedans the mortality was 3·2 per 1,000, and among Hindus 0·8 per 1,000.

Fevers.—The high mortality from fevers (4,037) is principally due to overcrowding and other defects in house sanitation. The most perfect drainage and the purest water supply will not diminish the death-rate of a city when the house sanitation is neglected. Very many of the buildings in Madras, especially in the crowded parts of the city, are erected with no regard whatsoever to ventilation. However much streets may be widened and improved, so long as proper ventilation is not attended to in buildings the health of the population cannot improve.

Bowel Complaints.—The number of deaths returned from bowel complaints was 2,911, of which 1,757 were from dysentery, and 1,154 from diarrhœa.

Mortality according to age.—The death-rate among infants continues to be high. The 5,309 deaths among children not exceeding one year old included 901 who died the same day they were born. The deaths among females are largely in excess of deaths among males between the ages of 15 and 30, which is the child-bearing epoch among women. More males are born than females, but before the completion of the first year, as a rule, more males die than females. During the year 1887, the difference was over 500. Between 1 and 10 years of age, more females than males die; this may be partly due to early marriages. From 40 upwards more females die than males.

Mortality according to sex.—Of 16,192 deaths, 8,035 were among males, and 8,157 among females, and these figures, when distributed among the different classes of population, show as follows:—

Sex.	Europeans.	East Indians.	Native Christians.	Hindus.	Mahomedans.
Males - -	51	177	334	6,409	1,064
Females - -	25	185	375	6,411	1,161

The death-rate, as in the year 1886, was highest in the 1st division and lowest in the 6th division. The reasons for this were given in the report for 1886.

In point of unhealthiness the 4th division stands next to 1st division. The different divisions may be arranged thus in point of unhealthiness:—

Division.	Death-rate per 1,000.	Division.	Death-rate per 1,000.
6th - - - - -	32·5	8th - - - -	40·7
5th - - - - -	35·3	7th - - - -	42·8
3rd - - - - -	39·3	4th - - - -	44·0
2nd - - - - -	39·9	1st - - - -	47·1

This ratio is much the same as that of 1886. The 8th division is still in want of a proper system of drainage, and overcrowding does still obtain in many parts of the city, giving rise to high death-rate. The difference of mortality in the different divisions has been exhaustively dealt with in the report of 1886 and therefore need not nowbe repeated.

ABSTRACT OF REPORT OF THE BOMBAY MUNICIPALITY FOR 1887-88.

(*Mr. F. L. Charles, Acting Municipal Commissioner*).

Tansa Waterworks.—As anticipated in my Administration Report for the last year, fair progress was made by Messrs. Walsh, Lovett, Mitchell & Co., on the duct contract, though the work has not advanced so far as to come up to the estimate of this year's out-turn. During the year, however, one of the partners, Mr. Lovett, came out from England, and by various changes and improvements of organisation the firm showed a sincere desire to carry on the work efficiently and expeditiously, and I expect a decidedly better rate of work in future as the result of his re-organisation. Time was undoubtedly lost at first by faulty arrangements; but there is every reason to hope that the contractors are now in a fair way to push on the work. This year a very large quantity of excavation for the duct was done, and the masonry work was in progress in different places. One set of compressed air machinery was working during the year at one of the tunnels, and four more were being put up at the close of the year. During the next working season there will thus be five sets at work. During the year only a small proportion, viz., 1,750 lineal feet, of the total quantity of the tunnel excavation to be done was finished; yet the progress made during the first year cannot be taken as a measure of the probable progress in future. The earthwork on the syphon sections has made very good progress. About 400 cylinders for the Bassein Creek bridges (out of a total of 500) were delivered on the works, and the work of erecting them on the three bridges was in progress. It is expected that the bridges will be entirely finished by about March 1890. Public works.

With reference to the Tansa Dam works, I stated in my last year's Administration Report that "though the masonry work done during the year is less than what was "expected owing to the confined position in the river-bed, yet a very large quantity "of excavation for foundations has been done, which will admit of greater progress "being made with the masonry in next year." I am glad to say now that the out-turn of work increased month by month. The masonry work done during the year was 1,541,021 cubic feet, which added to the work done previously—592,662 cubic feet—gives a total out-turn of 2,133,683 cubic feet. Excavations for foundations were in progress along the whole length of the dam line, and in certain places these had to be carried to a much greater depth than was estimated on the information derived from the trial pits; the levels of sound rock, sufficiently free from faults or fissures to be suitable for founding upon, being most capricious and irregular. This extra work will cause an excess on the estimate in the items of excavation for foundations and masonry; and, on reference to para. 20 of the report on this project, it will be seen that this contingency was not lost sight of. The officers' bungalow at Tansa was completed during the year.

The rainfall of the year, gauged at the site of the dam, was 106·28 inches. The average of the last three years, as gauged in the Tansa Valley, is 109·99 inches, and the average of the last nine years, based on a comparison with Kasara at the foot of the ghats, is 113 inches. When the report on the present project was prepared, the average rainfall in the valley was taken at only 100 inches, and the result of actual observation shows that the estimate is well within the mark.

Satisfactory progress has been made in the acquisition of land for the lake and the duct line, but as the works approach the Island of Bombay, some of the land-owners demand such high rates, based on the recent rise in the price of land in Bombay, that it is believed the amount provided in the estimate for the land compensation will not be sufficient.

Vehar and Tulsi.—The monsoon of 1887 was a very favourable one, the rainfall in July being unusually heavy. The Tulsi Lake overflowed on the 25th July 1887, and the Vehar Lake commenced to overflow on the 8th August. This early overflow was

chiefly due to the unusually heavy rain in the week ending 9th July 1887, 27·89 inches being gauged at Vehar and 25·43 at Tulsi. The work of replacing the puddle trench in the waste weir at Vehar by concrete, and repitching dam No. 2 and extending the puddle trench in that dam were commenced at the close of the year, and they will therefore be referred to in the next year's report.

The leakage which rendered these repairs necessary was computed as follows:—

Leakage from waste weir - - -	1,250,000 gallons.
„ „ dam No. 2 - -	200,000 „
Total daily loss -	1,450,000

The filter beds at Vehar, which were completed in 1886, were at work throughout the year, and give satisfactory results so far as their capacity extended. They are, however, only designed to be capable of efficiently dealing with about one-quarter of the water which is now drawn through the 24″ Vehar main. It will thus be seen that the extension of these filter beds is necessary, if the water delivered by that main (which chiefly supplies the northern parts of the island) is to be supplied free from impurities. The sluice house at Kurla on the 32″ Vehar main was rebuilt during the year to permit of the sluice valve being removed without pulling down the building, as was previously the case.

To prevent accidents to visitors, wire fencing was put up round the edge of the cliff at the Bhandarwada reservoir. The raising of the sluice house over the inlet main at Bhandarwada, in order to provide quarters for the inspector, as also the construction of a chawl for the workmen employed on the filters at Vehar, were undertaken at the end of the year, and will therefore be referred to in the next annual report.

Malabar Hill Roofing Works.—The roofing of the distribution basin was completed, and the water turned into it on the 20th June 1887, and the basin has been in use since that time. It was, however, since emptied on two occasions, once to fix an iron staircase, and again to allow of an alteration of the syphon pipe at the south end of the reservoir. This alteration was undertaken to allow of the main working by gravitation. The earthen embankment between the reservoir and the road on the east was also almost completed. The cost of the works up to date was Rs. 3,60,558. Some minor works are in progress.

Very serious inconvenience was caused by a landslip on the Gibbs Road near the entrance to the Towers of Silence on the 5th July 1887. This landslip was due to extensive excavations in the hill side, immediately below Gibbs Road, opposite the Towers of Silence, belonging to a private owner. This gentleman was warned of the danger by the executive engineer some months before the disaster. There had been heavy rain for the three days previous to the accident. On the 5th July, about 6.15 a.m., the landslip occurred, and carried with it a portion of the Gibbs Road, containing the 24″ Tulsi main, and the Gibbs Road 9″ main. Work was immediately commenced, and the repair of the 24″ main was completed on the night of the 8th and of the 9″ main on the 9th. I was very favourably impressed with the activity of the engineering department in the repair of this landslip. Work was not only started at once, but carried on by relays night and day. The work was completed at a cost of Rs. 5,268. A permanent retaining wall will be built after the rains. The rain falling almost continuously during the period diminished the demand for water, and the quantity of water in the storage basin at Malabar Hill was just sufficient to prevent a famine, the reservoir having been completely emptied before the water was turned on.

Laying of Mains.—Owing to the rapid expansion of the city, the laying of new mains in different localities has been necessary, and over 12 miles of new mains were laid down during the year. Of these, the most important was an 18″ main from the 48″ outlet main from the Bhandarwada Reservoir to Frere Road, where the demand for water has of late years very greatly increased on account of the construction of the docks and the erection of new buildings. This new main will enable either Vehar or Tulsi water to be supplied to the Docks. A portion of the work was completed at the close of the year, allowing Vehar water to be turned into the old 9″ main.

Pending the arrival of the Tansa water, it was found necessary to lay a 27″ main from the 24″ main on Parel Road along Kala Chawki Road, Arthur Road and Tardeo Road to Gowalia Tank Road, there connecting with the existing 32″ Vehar and 26″ Tulsi mains. This 27″ main forms part of the Tansa Project, being the branch from the Tansa 48″ main to the Malabar Hill Reservoir. The work of laying was in

progress at the end of the year. The object of laying this 27″ main in advance of the arrival of Tansa water is to allow of the delivering capacity of the Vehar 24″ main being utilised to the fullest possible extent.

On the 11th August 1887, 24 additional inspectors were sanctioned for the detection of waste of water, and the work done by the staff has again shown very satisfactory results. The work done up to December 1887 formed the subject of a separate report which has since been submitted to the Town Council. The saving of water in 1887 was 1,743,492 gallons daily, which, added to the 538,037 gallons per day saved in 1886, gives a total saving of 2,282,529 gallons per day. The greater part of this saving has been effected by the detection and repair of a large number of leaks from mains, service pipes, and fittings. But for the water saved by these operations, it would have been impossible to supply the very rapidly increasing demand.

The net increase, after deducting 268 disconnexions from the number of new connexions during the year, was 499 against 417 in 1886–87, an increase of 3·4 per cent. against 2·7 per cent., the average of the ten preceding years. These large annual increases in the number of connexions, coupled with an increased demand in many of the old connexions, necessarily increased the difficulty of satisfying the wants of the city; and until the Tansa water is available about November 1891, I anticipate very serious inconvenience. Indeed, I fear the question of limiting the supply for all purposes except domestic consumption may have to be seriously considered in order that the present supply may be made to suffice for the wants of the growing population in the last few years before the arrival of Tansa water.

Surface Drainage Works.—Rs. 5,720 were sanctioned on 18th May 1887 for filling in a small portion of the storm-water reservoir so as to form one straight line of bank between the eastern wing wall and the embankment over the main sewer, to do away with a backwater where scum collected. The whole of the work, except the pitching of a portion of the bank, has been completed. The great advantages of the scheme of this reservoir have been amply demonstrated by the experience of the past two years.

Queen's Road and Girgam Pipe Sewers and House Connexions for Sullage Water.—A grant of Rs. 11,14,929 was sanctioned by the Corporation on the 25th July 1887, and the tender of Messrs. Bulkley & Co. was accepted by the Town Council for the work on 22nd February 1888, but owing to necessary discussions of details it was not executed during the year. All arrangements are, however, now complete, and the work will be started after the rainy season is over.

The question of sewer ventilation formed the subject of much correspondence and discussion between the Superintending Engineer, N.D., the Sanitary Commissioner, the Executive Engineer, Municipality, and myself, and the relative efficiency of surface and shaft ventilation, as applied to sewers in Bombay, has been the principal point of discussion. To settle this vexed question, it has been decided to undertake experiments and observations on the relative effects of different systems of ventilation upon the air of the sewers, and the results of these experiments will be embodied in a future report. Ventilation of some kind is, of course, an urgent necessity in all sewers; but the choice of the best method is a matter of difficulty, some of the largest cities in Europe having adopted surface ventilation and some shaft ventilation.

Nearly all the house connexion work in the district of Khetvadi has been completed, and happily within the estimated rates, though the total grant was exceeded owing to the erection of new houses since the estimates were prepared.

Ovoid Sewer from the Crawford Markets to the Mint.—The whole of the sewer has been completed and finally cleaned and passed. The only work now remaining to be done is the erection of 16 ventilating shafts, sites for which are being selected.

The Fort Pipe Sewers.—The whole of the trunk pipe sewers, aggregating 9·49 miles in length, were laid and connected with the new ovoid sewer at its head near the Town Hall. The works remaining to be done consist of the ventilating shafts and the pipe drains or house branches, and these are in progress. Until the latter work is done, the sanitary condition of the Fort cannot be improved. Unfortunately the contractors did not work as well in this year as during 1886–87, and legal notice under the contract was on several occasions issued to compel them to proceed with greater energy.

As promised in the Administration Report for 1886–87, I applied to the Town Council in December 1887 for a grant of Rs. 11,700 for commencing the surveys and plans of pipe sewers and ovoid sewers in Umarkhari, Bhuleshwar, Kharatalao, Tarvadi, Mazagon, Byculla, Chinchpokli and Parel Districts, but as the expenditure was at first vetoed by the Corporation though subsequently passed on my bringing the matter forward a second time, the result of the surveys will be reviewed next year. These sewers are very urgently required. I earnestly hope that the scheme may be passed as soon as the estimates are ready. The condition of some parts of these sections is perfectly frightful, sewage simply soaking into the ground for want of an outlet.

Roads and Buildings.—The following table represents the increase in the number of buildings passed by the Building Department for the last five years:—

1883–84	607	1886–87	983
1884–85	763	1887–88	1,122
1885–86	823		

It will thus be seen that the number of buildings commenced in the year was greater by nearly 50 per cent. than in 1883–84. It is a question whether building is not being overdone, and a temporary re-action may, perhaps, be looked for a few years hence.

Jacob Fountain.—The design of the Jacob Fountain, referred to in para. 60 of the Administration Report of the last year, was approved by the Corporation in October 1886. The work was commenced in December 1886 at the cost of Colonel Jacob, and completed on 16th January 1888. The fountain is a very handsome addition to the ornaments of the city, being constructed of marble carved in Jeypore.

Small-pox Hospital, Arthur Road.—The Corporation voted the sum of Rs. 39,636 in February 1887 for the construction of a Small-pox Hospital, with outhouses, and the work was commenced in October 1887, the greater part having been completed during the year. The cost of work done to the end of the year was Rs. 22,953. The compound being low-lying ground will eventually have to be filled in.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1887.

(*Surgeon-Major T. S. Weir.*)

Public health.

THE public health may be considered to have been favourable during the past year. The death-rate is a little over 23 per 1,000, but probably it is a little less considering the extraordinary expansion of the city. I doubt whether the increase of population is fully estimated. The total deaths are 1,180 less than the average, and 439 more than in the previous year. Contrasted with the previous year, there has been a reduction of mortality from measles, fevers, diseases of the nervous system, and deaths from accidents. It must be recollected that 1886 was a remarkable year in the sanitary history of this city; in that year the smallest number of deaths ever recorded in Bombay from cholera and small-pox were registered.

The total deaths, the rate of mortality of males and females, and the proportion of male to female deaths in each year since 1880 are contrasted in the table following:—

Years.	Total Deaths.	Death-rate.		Proportion of Male to Female Deaths.
		Males.	Females.	
1881	21,856	24·94	33·27	112·97
1882	20,468	23·36	31·14	113·05
1883	23,530	26·62	36·16	119·00
1884	22,542	25·29	34·96	109·01
1885	21,850	24·58	33·80	109·57
1886	20,074	22·45	31·24	108·27
1887	20,513	23·15	31·62	110·32

Before examining the mortuary statistics further, I will make some observations on questions of sanitary importance which have either been or are now under consideration.

The Law and Magistrates: Adulteration of Food.—There is no use in having a law to punish persons for adulteration of food unless magistrates enforce the law and punish the persons who do adulterate and sell adulterated food. The practical question will be, when there is an Adulteration Act, how is a magistrate to be compelled to punish people as the public think people for the offence of adulteration ought to be punished, for municipal officers represent the public, and the poor public especially. There is no use in having an Adulteration Act unless that persons offending against the Act are punished. One magistrate considers that municipal officers are making a prosecuting machine of his court, although municipal officers have always considered, and I believe rightly, that the courts were machines by which persons should be punished. If there is to be an Adulteration Act it must be distinctly understood that it is the duty of municipal officers to enforce that Act. It is not right that any opprobrium should attach to public officers for doing that which the law compels them to do. I am far from suggesting that the charges which we bring against persons for offending the law do not receive attentive consideration. Our prosecutions have received the most careful consideration of magistrates, and some magistrates, after giving very patient attention to cases, have come and seen serious nuisances from which we have been endeavouring to protect the general public and the poor who cannot protect themselves. The fact is that in this city the magistrates are too few to hear all the cases which should be brought before them. But there is likely to be, as there has been, a difference of opinion between some magistrates and us as to our duty to the public and as to the intentions of those who framed the Municipal Law; we consider that our duty is to

protect the public, a magistrate is prone—that is my complaint—to consider the protection of the public secondary to the intentions of the law-makers. The magistrate looks to legal phrases; we look not to words, but to the public safety. One magistrate has expressed an opinion that the causing or permitting of a nuisance ought *not* to be considered a *criminal offence*, because there was no criminal intent. This is the view of a magistrate, but I do not think it is the view of people who suffer from a nuisance. It is the difference of being far from and close to a nuisance.

Open Drains.—I am in favour of open drains between buildings and street arteries for the outlying portions of the city. If there was above each sweeper's gully a water-pipe and a stream of water flowing down the gully, the condition of the sweeper's gullies or passages would be totally different to what the condition of the gullies now is and must be, and the sweeper's gullies would form safe passages for the conveyance of liquid refuse from buildings to sewers.

Density of Population.—In the last Annual Report, in writing of the density of the population, I pointed out that the density of the population was chiefly due to want of roads, and that there was not a want of space for the population—for more than half the Island had a small population—but want of roads to open space. The city is compressed because of want of roads to open ground and open space which cannot now be made use of. Not only is the construction of roads in the suburbs necessary, but I regard the widening of roads, especially on the eastern side of the island, of the highest sanitary importance. I would also suggest the construction of footpaths by the side of the water-pipes laid down the northern valley; in these portions of the city the people have either to wade through rice-fields in going by the shortest ways or to go a long distance by the few public roads. To the north of Dadur, east and west, roads or footways are very much needed. A few years ago the absence of roads in this portion of the city was not of any importance, but now it is of importance, for a large population is collecting in the north of the island, and roads are needed for their use.

Nuisance caused by Factories.—I have observed during the year a serious public nuisance caused by fluff from cotton mills, and I have seen some of the public roads looking as if a shower of snow had fallen. I found cotton fluff blown from a mill a distance of 250 yards, and deposited in a building and in rooms and on windows and beds. I drew the attention of the Inspector of Factories to this nuisance caused through fluff escaping from mills, but the Inspector apparently cannot prevent the nuisance under the Factory Act. He wrote to me as follows:—"This is a matter over "which I have no control whatever under the Factories Act. It is one entirely for "your Department." I am doubtful whether this imperfect mill arrangement, and the nuisance and injury to health from it, can be prevented under the proposed Municipal Law; owners of factories allowing dust to escape in such a way as to cause nuisance can be prosecuted; cotton fluff, I hope, can legally be considered to be a substance referred to in the Act.

Factory Labour.—I am satisfied that the law does not give sufficient protection to young boys and girls working in factories in this city. The relations of people working in factories, as well as the operatives, are coming to understand that factory life is devitalising; they say that young people especially cannot continue working in factories without losing their health and strength, and that a complete rest, every two or three years, is necessary to preserve health. The influence of factory life, considering the extension of manufacturing enterprise and the number of persons living by it, is of great public importance. To judge of the effect of factory life compare the appearance of men and women engaged in hard out-door work, such as quarrying, with the appearance of factory labourers. I have been struck with the difference in the appearance of the two classes of labourers walking side by side at the end of a day's work—the mill labourers, feeble, weak, and having a pallid look; the quarrymen and women with active springy gait, and of cheerful look, after hard work under the sun; such are the outward effects of hard in-door factory and of hard out-door quarry labour, which can be observed by anyone on any evening. It must, however, be remembered that the quarry labourers and the factory hands come from different classes; the quarry labourers are chiefly from the Deccan, whereas the factory hands are from the Coast plains. What is absolutely necessary is the protection of young people against being compelled by parents and relatives to work beyond their strength. The Factory Act does give such protection to children under a certain age, but it does not protect young people older than nine years of age, and for whom protection is just as much needed. I am certain that factory work will have a most injurious influence on the population from whom its workers are drawn.

I think the Factory Act should be worked and enforced by the police, and that a reward should be given for each conviction under section 7, which enacts: "No child " shall be actually employed in any factory more than nine hours in any one day."

There is not the slightest doubt that there are a number of boys and girls under 15 years of age who are compelled by their relatives to work in the heat of the factories 12 hours a day. The effect is that these young people have to cease from all work and to return to their villages after a couple of years of this labour. It is not the factory proprietors who are to blame so much as the parents and relatives of these children and young people. It is fortunate that the workers in the mills have a connexion with the soil, and may return to till it; the workers themselves say that they require every few years complete rest from factory labour, and must return for some months to renew their vitality by labour in the fields. At any rate there is growing up in our population a class which can be distinguished from their own class, from their own race engaged in other work, and from every other class, by a pallid look which may be called a " factory countenance."

The influence which factory smoke is found to have on the tender mango blossoms, and on the health and productiveness of mango trees is suggestive of the influence which factory impurities in the atmosphere may have on delicate human health. In the case of the mango tree near factories, we have a very striking proof of the effect which air impurity can have on the health of trees.

Railway Sanitation.—There is no accommodation at any of the railway stations for sick passengers. One company has medicines at each station for sick passengers, and the other company has not. When on leave, I was struck with the much greater sanitary comfort in which third-class passengers in the Caucasus travel than in India, notwithstanding inferior railway organisation in other respects in the Caucasus. The arrangement of the carriage space is much more strict than in India, and not only is the duty of passengers to the railway strictly insisted on, but the duty of passengers to passengers, and the passengers are protected against the selfishness of selfish passengers. Owing to the arrangement of the carriages, the latrine accommodation in one class may in an emergency be used by any other class passengers while the train is in motion. There is an increasing railway traffic to this city, and an increasing number of toilers from all parts of India cast into the population. The condition in which third-class passengers are brought to the city is of great sanitary importance. I have no hesitation in writing that the conditions under which third-class passengers are carried to and unloaded in the city, must have an injurious effect on the health of the passengers, and, secondly, on the health of the city. The absence of proper latrine accommodation in third-class carriages inflicts suffering, especially on the weak or sickly passengers, who must either foul the carriages or attempt to do what they have little strength for—to run to conveniences in railway stations which ought to be in the train. There is now as much necessity for the supervision of the railway traffic as there is for any other form of sanitary supervision over the movements of the population.

Street Nuisances.—I have brought to your (Municipal Commissioner) notice the necessity of preventing the nuisance caused by children using at all times for natural purposes the footpaths of streets, and even the footpaths of some of the thoroughfares of greatest traffic in the city. Children are allowed to commit nuisances in a way that causes very great annoyance to the general public. This annoyance is greatest in the crowded portions of the city. As it is impossible to keep footpaths clean and sweet for traffic so long as children are permitted to foul them, and people are permitted to wash children on them, I proposed the following section for your consideration:—" Whoever being the parent or guardian of a child under 10 years of " age permits or allows such child to use a public street or thoroughfare to which the " public have access, for natural purposes, shall be liable to a penalty of Rs. 50 (fifty) " for such offence." This nuisance was not referred to in the draft Municipal Act, and hence the proposal. The proposal was referred to the solicitors for opinion, and they were of opinion, " even if the legislature were to entertain such a provision as " that suggested by Dr. Weir (and this we cannot help thinking is most unlikely), " it seems to us that practically it would be unworkable, as we do not think any " magistrate would ever feel justified in inflicting a fine on the parents in such cases. " We can find no precedent for any such enactment, and we are disposed to think that " the matter is one that can only be dealt with under the Police Act, and so far as " very young children are concerned, we must admit that we can suggest no way in " which it can be very satisfactorily dealt with at all." If it is understood that the

nuisance cannot be dealt with by the Health Department, well and good, but unfortunately it is not so understood, and the Health Department are reproached for not doing what they cannot do.

Mortality.—The deaths amongst the indigenous population are more than the deaths amongst immigrants; 10,405 persons born in Bombay against 9,926 born elsewhere died; the deaths of persons born in Bombay were only 69 more than in 1886, whereas the deaths of immigrants were 352 more.

The sections of highest mortality are 2nd Nagpada (41·76), Mahaluxmi (39·47), Chuckla (38·38), Kamathipura (37·11), Tarwadi (36·37), and Parel (35·39). In the former year the second highest mortality, and nearly the highest mortality, was also registered in 2nd Nagpada; I have in the report for that year, and also in other reports, referred to insanitary conditions within this section. There is in this section, as I wrote last year, intense house-crowding, imperfect house ventilation, and bad drainage. Not only does the total mortality indicate the bad sanitary condition of this locality, and the unfavourable chances of life, but the proportion of infant mortality also indicates the same. I believe the chances of life are better in Mahaluxmi, Tarwadi, and Parel than indicated by the total mortality. The high mortality in these sections is greatly affected by fluctuation and increase of population, although there are defective sanitary conditions, and especially absence of drainage in all three sections. In other portions of this report I have drawn attention to the foulness arising from population collecting in Parel and Tarwadi on land not prepared for population, and land not having drains to carry away the refuse of the population collected on it.

The mortality arranged in groups of important death causes is exhibited in the table following. Contrasted with the preceding year there is a reduction in the mortality from the following causes:—Measles, fevers, and diseases of the nervous system, and an increase in the mortality from phthisis, diseases of the respiratory system, small-pox, cholera, diarrhœa, and dysentery, in fact chiefly an increase from two epidemic causes—small-pox and cholera, and choleraic affections. It must be recollected that 1886 is memorable in the sanitary history of this city as the year of the smallest number of deaths from cholera and small-pox, and that the mortality from both causes was extraordinarily low. In the Annual Report of 1886 I referred to the small number of deaths from cholera and small-pox in that year as follows:—"So small a "mortality as 19 from cholera—a very remarkable sanitary event for this city—and "that event is still more remarkable through the occurrence of an equally low mortality "from small-pox."

Return showing the Number of Deaths from different Causes in 1887.

Causes of Death.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Small-pox	108	·12	Annual increment of population is calculated.
Measles	547	·62	
Fever	5,612	6·36	
Cholera	269	·31	
Phthisis	2,701	3·06	
Diseases of the Nervous System	1,981	2·25	
„ Respiratory „	3,866	4·38	
Diarrhœa	1,070	1·21	
Dysentery	570	·65	
Accidents	364	·41	
All other causes except Still-born	3,425	3·88	
Total	20,513	23·25	

The rate of mortality amongst the great and increasing mass of the Hindu population may be considered favourable; a death-rate of 24·1 per 1,000 on a population enumerated in 1881 is not high. In regard to the mortality amongst the small class of Jains (53·89), I have had to examine houses occupied by some of the Jain population because of their unwholesome condition; their condition was very bad—the ground-floors so dark that a light had to be kept in the day time, and this darkness of building, with imperfect and dangerous house-drainage—under-ground

floor. Many of the poorer classes of Jains who come here to find a living dwell in very unwholesome buildings and under very unfavourable conditions.

An impression exists that the mortality of Parsee females during the nubile period of life is comparatively higher than amongst females in any other class; this impression is a mistaken one, as the health statistics of this city show that Parsee women and children, as well as Parsee men, have greater chances of life than most other classes in our population. Besides other conditions favourable to health under which Parsees live, there is one condition to be observed in houses of the Parsee population in crowded localities, and that condition is the dry state of the ground-floor as compared with what may be seen in other houses of other classes in crowded localities, for the ground-floors in houses of Parsees are less water-saturated than in the houses of some other classes. In each Parsee house is a well, and I think it is not improbable that the existence of this well, when the water is not contaminated, is in some ways favourable to the health of the people; a well tends to keep dry the ground-floor, and as there is an open space over the well, it brings light which would not be admitted but for the well, and Parsees are very careful to notice impurity of well water within their houses.

The mortality in the four great classes of the population usually taken in each year for comparative examination exhibits an increase of mortality amongst Mussulman (from 30·57 in 1886 to 31·74 in 1887), and a slight enhancement of mortality amongst Brahmin classes (from 20·71 to 20·85), and a decrease in the mortality of Parsees (from 21·42 to 20·47), and Europeans (from 17·89 to 17·22). The health of three of the classes, Brahmins, Parsees, and Europeans, is exhibited in a very favourable condition, for in two of the classes—Europeans and Brahmins—there has been a considerable increase of population, and yet the mortality of Europeans is only 17·2, and the mortality of Brahmans 20·8 per 1,000. The mortality of Europeans in this city has not been so low for many years as in 1887. I believe that one great cause affecting the mortality of the Mussulman population is imperfect street and house ventilation, arising out of the house pressure and overcrowding in the localities in which great numbers of Mussulman live. There has also been a great increase in the Mussulman population, still, notwithstanding such increase, the mortality is high, and were it not for the great attention paid to personal sanitation and food selection by Mussulmans, this overcrowding and imperfect house ventilation would cause a very much greater fatality. It must be noted that the mortality from all epidemic causes amongst the Mussulman population is below the average, while the mortality from fevers especially is above the average. There is also a considerable difference between the male and female mortality, the male mortality being 26·62 and the female 39·31 per 1,000 of population.

As in the previous year, the mortality of male children under 1 year of age is higher than the mortality of female children, while from 1 to 5 years the mortality of male children is lower. Between 12 and 40 years of age, the mortality of females is 6·51 per thousand higher than of males. The total mortality of children under 1 year of age is 9 less than in 1886, and this infant mortality is distributed by sex in the following rates: males, 290·78; females, 236·09; while in the preceding year the infant death-rate of males was 287·81, and females, 239·74. A further examination of the infant mortality shows that, considering the resuscitation of small-pox and the mortality from cholera and measles, the health of the infant population during this year has been more favourable than might have been expected, and compares favourably with the preceding year. The proportion of deaths of infants to population is nearly the same as in the previous year, while the proportion of deaths to births is 1·40 less. The total female mortality is 8·4 higher than the male mortality; the excess is a little less than in the foregoing year. The excess of female mortality during the nubile period is 6·51 against 7·58 in 1886.

Small-pox.

From small-pox 108 deaths have been registered. This is a mortality 89 more than in the last year, but 240 less than the average of the five years preceding. There has, therefore, been the resuscitation of small-pox which I anticipated in the Annual Report for 1886 and in the First Quarterly Report of 1887. In the Annual Report for 1886 I wrote:—"The indications of a resuscitation of small-pox, which have generally been "observed in the period preceding an epidemic, must be carefully looked for towards "the end of 1887. I apprehend the occurrence of an epidemic of small-pox in 1888, "from certain indications I observed late in the hot season of this year, and if cases of "small-pox occur in the monsoon months of 1887, they may be considered, judging

"from previous experience, as of grave import. I pointed out in previous reports the "danger that exists from unprotected adults and infants, and such danger has been "manifest in previous epidemics. It is necessary that the vaccination of stranger "adults and re-vaccination should be made compulsory. The fatality of each epidemic "is influenced by the susceptibility of unprotected adults."

Fevers. There is a further reduction in the mortality from fevers this year. This is satisfactory. In the previous year there was also a remarkable reduction in the deaths from fevers. In 1886, 5,820 deaths from fevers were registered, being 828 deaths less than in the previous year and 434 less than the average of the five preceding years; and in 1887 the mortality from fevers is 208 less than in 1886 and 519 less than the average. 5,612 deaths have been registered from fevers. 4,179 were referred to remittent fever, being 300 less than in the last year and 541 less than the average; 187 were ascribed to ague, being 41 more than in the last year, but 73 less than the average; 1,227 were referred to simple continued fever, being 50 more than in the last year and 94 more than the average; 19 were referred to enteric fever, being one more than in the last year and one more than the mean. Although the registration of fever types cannot be considered exact, the statistics indicate a reduction of total fever fatality.

The general distribution of mortality in localities has been nearly the same as in the last year. In 19 sections the mortality is above the average of the whole city, and in 13 below. A reduction of mortality since 1886 has occurred in the following sections:—Upper Colaba, Middle Colaba, Fort Northern, Market, Mandvi, Oomarkhari, Dongree, Dhobi Talao, Fanaswadi, Bhuleshwar, Kumbharwada, Khetwadi, Girgaum, Chaupati, Walkeshwar, Tarwadi, 2nd Nagpada, Tardeo, 1st Nagpada, and Worli.

A reduction in fever mortality is observed in most of the sections in which sewer lines have recently been laid, although it must be recollected in considering such reduction that in some other sections in which new sewers have not been laid there has also been a reduction of fever mortality; still there is the fact that of the 12 sections in which the mortality from fevers is higher than in 1886, there were sewer lines laid in only five of them, and of these five sections completely only in one so far as liquid refuse, and in two sections laid down merely in a few streets.

Measles. The rate of mortality from measles amongst males and females is very nearly the same as in the preceding year. The male mortality being ·55 per 1,000 and the female ·93; while in the previous year the male mortality was ·58 and the female ·97. The deaths from measles are 547, or 25 less than the last year, and 5 less than the average of the five years preceding. The course of measles follows the seasonal incidence of small-pox. The greatest number of deaths occurred in March and April, 102 and 113 in each month, in May the deaths fell to 95, in June to 51, in July to 18, in August to 17, in September to 7, in October to 6, in November to 5, while in December, with the approach of the cold weather, the deaths increased to 14.

Cholera. During 1887 the incidence of cholera had an epidemic tendency. The very remarkable sanitary event of 1886 was not observed in 1887; in 1886 only 19 deaths from cholera occurred, and that small mortality was accompanied by an equally low mortality from small-pox. 1874 and 1880 are the only two years in which a mortality nearly as low as in 1886 occurred from cholera; in 1886, 19 deaths occurred; in 1874, 20; and in 1880, 30. As I anticipated, a very much larger number of deaths from cholera occurred in 1887, and a resuscitation of small-pox was observed towards the end of the year. These evidences of zymotic prevalence in this city were synchronous with epidemic prevalence in the country around.

Of 427 cases of cholera which came to my notice, 269 ended fatally. Only 75 of the total cases were born in Bombay, and as many as 346 were known to have been born somewhere out of Bombay.

——	Attacked.	Died.	Per cent.
Males - - - -	294	187	63·60
Females - - - -	133	82	61·65

Of the 75 cases born in Bombay, 43 terminated fatally, giving a mortality of 57 per cent., whereas of the 346 strangers 220 died, giving a mortality of 63 per cent. The explanation is this: the strangers were generally of a poorer class, and lived under less favourable conditions than the indigenous born in Bombay. The great labouring mass which rolls from and to this city backwards and forwards is very susceptible to disease. The great industrial activity in this city has attracted an enormous number of labourers. If the period of residence is grouped into two periods, under three months and under six months, the following results are found:—

——	Cases.	Deaths.
Under 3 months - - - -	70	40
Under 6 months - - -	48	35

The water-supply generally used by those who suffered from cholera indicates that the use of well-water as an ordinary source of drinking water is decreasing. Of the 427 cases, 27 commonly used well-water, and of the 27, 13 died. The use of well-water is becoming less frequent since the filtration of pipe-water has commenced. A classification of the cases of cholera, according to the source of water-supply, gives the following results:—

——	Attacked.	Died.	Per cent.
Vehar and Tulsi water consumers -	323	212	65·63
Well-water drinkers - - -	27	13	48·14
Unknown - - - - -	77	45	58·44

An examination of the room location of those who suffered from cholera gives very remarkable and valuable information; of those who were attacked as many as 263, that is 61·59 per cent., live on the ground floor, and 156 died; 79 on the first floor, and 55 died; 34 on the second floor, and 24 died; 11 on the third floor, and 7 died; and 6 on the fourth floor, and 2 died. Examining these figures further, we find that 61·59 per cent. occurred on the ground floor, and 18·50 per cent. on the first floor, while the percentage of ground floors to total houses is 40·01, and the percentage of first floors to total houses 26·34. The figures show that a very large proportion of the persons who suffered from cholera lived on the ground floor, and that persons living on the ground floor have not in this city of dampness as good chances of life as persons living on the higher floors. The persons living on the ground floor are generally of the poorer classes, and neither the conditions amidst which they live nor the conditions of their lives are so favourable as observed on the higher floors. The condition most generally surrounding groups of cholera cases is dampness—dampness from imperfect drainage and imperfect ventilation. We have, therefore, the two conditions of bad dwelling and poor living influencing the classes who suffer most from cholera. There has always been in this city a remarkable connexion between material conditions of life and the incidence of cholera, and we have seen that certain classes living under certain conditions of life and dwelling are most susceptible.

Although the degree of crowding is fearful, it is most difficult to lessen it; practically I doubt if it can be lessened, but its effects may be abated. The problem is a most grave one, and its solution is not nearer now than it was many years ago. Neither the present municipal law nor the future, so far as I can see, will prevent overcrowding, but the effects of overcrowding may be rendered less hurtful by providing plentiful openings for the escape of foul air and for the admission of pure air, but these openings must be of such size and in such positions that they cannot be easily closed.

The prevalence of choleraic cases was observed from the beginning of July; in the early part of the year, up to the end of June, the mortality from cholera was unusually low. Apart from epidemic influences around the city—and I have in other reports referred to the effect of such influences on the mortality of the city—the local exciting causes have not been of the nature generally surrounding groups of cases and influencing the incidence of the mortality in former years. A relation appears probable between cases imported and the general occurrence of cases after the first

week in July. It is remarkable that the wider incidence of cases and the more general prevalence of choleraic affections in the city followed on the importation of cases into the city. The resuscitation of choleraic affections from the beginning of July is not to be ascribed solely to imported cases, and I am far from wishing to do so, for, while epidemic influences are active, it is impossible to conclusively refer to any one force or cause results which we know to have arisen at other times from other forces or exciting causes. Such prevalence as has existed followed on the importation of cases from Pandharpur. That the imported cases exerted an influence on the incidence of the disease appears probable, although against the suggestion of communication through importation many obvious objections may be urged, such as the occurrence of a certain number of cases in one dwelling, or group of dwellings, followed by cessation of cases, and the occurrence of single cases at intervals at distant points after exacerbation of choleraic affections not followed by other cases at such points; but, on the other hand, the incidence of cholera as of other diseases is greatly influenced by individual and other conditions of susceptibility. The practical sanitary lesson to be remembered is that the importation of cases during a season of epidemic activity is a serious occurrence, and likely to be followed by other cases and to have an unfavourable influence on the conditions of public health.

The conditions surrounding cases have not generally been of the special insanitary nature observed in former years. There has been no great concentration of cases around special sources of water-supply or defective conditions of dwelling or locality. The incidence of cases has not been strongly localised at periods as in former years. The incidence of the disease indicates influences affecting the occurrence of cases other than those arising from special local insanitary causes.

The experience of this year indicates the unfavourable influence of imported cases of cholera when epidemic conditions exist. At one period during the month of July it appeared as if the occurrence of the cases was acquiring an epidemic force, but such influence became less in September, and the mortality fell from 103 in August to 48 in September. The greatest number of cases occurred in the large class of the Hindu population denominated in the table "Hindus of other Castes," while the highest proportion of deaths to population occurred in the Native Christian and Eurasian classes. The highest fatality to attacks occurred in two classes, amongst whom the highest fatality would not be expected—Europeans and Parsees—and the lowest amongst Mussulmans and Brahmins, but the death-rate to population from cholera amongst Europeans and Parsees was low. The proportion of deaths to cases was 11·46 per cent. amongst Mussulman classes, and it has been observed in former years that the chances of life of Mussulman suffering from cholera were greater than of some other classes.

The measures adopted were of the precautionary and preventive character, always stringently enforced by this Department, and they were successful. I am glad to be able to report that the measures taken, although they imposed a heavy duty and serious responsibility on the officers of the Health Department, did not impose any additional expenditure on the municipality. The measures adopted were carried out by the permanent staff without any assistance and without any additional expenditure.

Phthisis.

The mortality from phthisis (2,701) is 27 more than last year, but less than the average of the five preceding years. The five sections in which the highest mortality in the previous year occurred from phthisis are also the five sections in which the highest mortality has occurred this year; they are 2nd Nagpada, Chuckla, Bhuleshwar, Oomarkhari, and Khara Talao, and they are all sections of the most dense street and house-crowding. Kamathipura, which occupies the eighth place in 1887 in the phthisical record, occupied the seventh place in 1886, the sixth place in 1885, and the fifth place in 1884. There has, therefore, been from year to year a progressive fall in the phthisical mortality in Kamathipura during each of the last five years. At the same time it must be recollected that there has been an increase in the mortality from affections of the respiratory system in Kamathipura. It is necessary that the drainage scheme and system of house connexions for liquids should be completed in this section, so as to include every portion of the section. There is still one street —one of the most populous and room-crowded—which has not yet been drained or treated on the new system. I am very anxious that the drainage of this section should be completed, and that the section should be, as a registration unit of drainage, complete.

The mortality from diseases of the digestive system is 212 more than in the last year, and 36 more than the average; of the deaths from diseases of the digestive

system 1,070 were referred to diarrhœa, being 38 more than in 1886, and 9 more than the average; 570 to dysentery, being 86 more than in the last year and 9 less than the average. To all other diseases of the digestive system, 588 deaths were ascribed, being 88 more than in the last year and 36 more than the average.

From diseases of the respiratory system 3,866 deaths were registered, being 56 more than in the last year and 239 more than the average; of the deaths from diseases of the respiratory system 2,375 were referred to bronchitis, being 61 less than in the last year and 177 more than the average; 864 to pneumonia, being 78 more than in the last year and 135 more than the average. The greater mortality from diseases of the respiratory system indicates the necessity of measures for the treatment of unwholesome dwellings. As the population increases the necessity for improving the ventilation of buildings and for securing open space around them is becoming more urgent. I have, in the Annual Report for 1885, written at length on the weakness of the municipal law bearing on house sanitation; the improvement of house sanitation cannot be effected until a new law has come into force.

Registered births.

There has been an improvement in birth registration and a greater number of births registered; this improvement I expected. The number of births registered is 520 more than in the last year. 15,429 living and 1,199 still-born births were registered; of the living births 7,992 were males and 7,437 females. The birth-rate has fluctuated very much in different localities from 44·4 per 1,000 in Parel, 37·2 in 1st Nagpada, and 33·8 in Upper Colaba to 8·5 in the Fort South.

Amongst classes the birth-rate has fluctuated very much, from 81·33 amongst Eurasians—a birth-rate which I consider to be fictitious—to 8·1 amongst Brahmins, and between these extremes we have a Jewish birth-rate of 39·7 and a Parsee birth-rate of 27 per 1,000. Amongst the mass of the Hindu population 495 more births were registered than in the last year. This is satisfactory.

APPENDIX.

DESPATCH TO THE GOVERNMENT OF INDIA, DATED, 10th JANUARY 1889.

MY LORD MARQUIS,

I HAVE received and considered in Council your letter, dated 11th August 1888, No. 11 (Home, Sanitary), enclosing a copy of a Resolution* of your Government, on the general subject of the measures to be adopted for the promotion of sanitary reform in India.

2. I have read this Resolution with great interest, and have to express my entire approval of the principles and lines of action which it recommends.

3. It has been for many years past represented by the Army Sanitary Commission, and by other authorities, that, while a vast amount of work has been done in India in the collection of statistics, and in the investigation of disease causes, these measures have led to no great practical results, owing to the absence of any real executive authority in sanitary matters, and to the want of a systematic provision of funds for sanitary purposes, defects which it is specially necessary to remedy in a country where Native sentiment is often arrayed against measures taken for the improvement of the public health.

4. I agree in the view of your Excellency's Government that it is necessary to take vigorous and systematic action in the direction of sanitary improvement, and a draft Despatch upon the subject was under my consideration in Council, when I received intimation that you were taking action in the matter.

5. I forward, for the information of your Excellency's Government, a Minute submitted to me by Colonel H. Yule, C.B., Member of the Council of India, on the subject of sanitation in India. Colonel Yule has for several years sat on the Army Sanitary Commission in behalf of the Secretary of State for India; his experience on that Commission, the interest he has always taken on the subject, and his knowledge of India, entitle his remarks to much respect, and I commend the Minute to the consideration of your Government and of your sanitary officers.

I have, &c.

(Signed) CROSS.

ENCLOSURE.

MINUTE by Colonel HENRY YULE, C.B.

[The paper which follows is substantially matter which was prepared more than a twelvemonth ago, and laid before the Secretary of State in March last, with the intention that it should form the basis of a Despatch to the Government of India on the sanitary question. For various reasons a decision was delayed, and eventually the object of the intended Despatch was in a considerable measure anticipated by the Resolution of the Government of India of 27th July last.

But it is, I understand, the desire of the Secretary of State that the substance of the original papers submitted by the undersigned should be forwarded to the Government of India, and I now put it forward in a formal Minute. Some slight modifications have been made, bringing such statistics as are quoted down to a more recent date than was originally available.

H. Y.]

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1. I have long had it on my mind that, in some form, the Government of India should be addressed on the sanitary question, with a general review of its position, and especially with regard to the sort of "thus far and no farther" to which we seem to have come for some time past.

In such a Despatch it would be desirable to review, so far as is possible within moderate limits, the present position of sanitary administration in India, as affecting both Her Majesty's forces and the general population; to form some estimate of the degree in which that administration can be regarded as adequately discharging the duties of our Government in cherishing the health

* Reprinted in the Report on Sanitary Measures in India in 1886–87 [C. 5533], pages 38 to 42.

of its troops, in protecting the population from the ravages of epidemic disease, and in raising the standard of public health; as well as to consider what steps are practicable in order that those duties may be more effectually performed.

2. We shall see that the substantial character of the benefits to the Army resulting from reforms that may be considered to date, with more or less precision, from the appointment of the Royal Commission of 1859, is happily quite beyond dispute. But we shall see also that, whilst even in respect to the health of the Army there are considerable deductions to be made, as regards the civil population generally, though with admitted exceptions in the case of some of the larger municipal towns, little progress can be claimed, and a denial can hardly be given to the allegation of the existing Army Sanitary Committee that, though the Indian Sanitary Department furnishes much information as to the history of health, and a mass of valuable statistics, their reports are not followed by any serious amount of corresponding action, and the recurrence of extensive mortality from fever, and other endemic and epidemic diseases, is not materially impeded.

3. The Report of the Royal Commission of 1859, dated 19th May 1863, was intended to be forwarded to India with the Secretary of State's Military Despatch of 31st July, No. 280, followed by another (No. 297, of 15th August), in which the attention of the Government of India was drawn to the report at some length, and the most important of the Commission's recommendations were indicated for special consideration. These were:—

1. The appointment of a sanitary commission at each of the Presidencies.
2. A careful consideration of the changes which might be found necessary in the existing distribution of European troops.
3. Measures to be taken for the selection of new sites for barracks; in the construction of new barracks on approved principles; and in the application, so far as possible, of these principles to existing buildings.
4. The regulation of the diet of European troops, and the prevention, if possible, of the use by them of ardent spirits.
5. The provision of means for the innocent recreation and healthy occupation of the men.
6. Measures to be adopted to prevent the spread of venereal disease.

4. Owing to accident, copies of the Commission's Report did not reach Calcutta till January 1864. On the 5th February the Government of India reported their having directed the immediate formation of Sanitary Commissions in the three Presidency towns.

The Commission as constituted in Calcutta consisted of a civil officer (Mr. John Strachey) as president, with a medical officer as secretary, along with a second medical officer and two military officers, one of them an engineer, as additional members. The president and secretary were to devote their whole time to the Commission; the other three attended it, whilst retaining charge of other duties.

A general indication of the intentions of Government in constituting this new system of sanitary administration was addressed to the Commission.* In this it was pointed out that the full improvement of the health of the European troops, which was hoped for could not be brought about by measures solely directed to the amelioration of the sanitary condition of the soldiers as such. No amount of care in cantonments would be effectual if all sanitary precautions were neglected in the towns adjacent. A great system of sanitary administration could not be created in a day; but the Government looked for the gradual establishment of such a system throughout the country which should be both comprehensive and uniform. Every step wisely taken towards the improvement of the public health would be a step towards higher civilisation and better government. On the duties of the Sanitary Commission the Government quoted from the recommendation of the Royal Commission's Report, which ran that the Presidential Commissions should be—

"So constituted as to represent the various elements, civil, military, engineering, sanitary, and medical; †*to give advice and assistance on all matters relating to the public health, such as selection of new stations and the sanitary improvement of existing stations and bazaars; to examine new plans for barracks and hospitals; to advise on the laying out of stations and bazaars, the sanitary improvement of Native towns, the prevention and mitigation of epidemic diseases, and generally to exercise a constant oversight on the sanitary condition of the population, European and Native; to report on the prevalence, causes, and means of preventing sickness and disease;* and further, that administrative measures should be adopted to give effect to the advice of the Presidency Commissions. (Also) that trained medical officers of health should be appointed to act, in peace as in war, in connexion with these Commissions."

So far as local causes of disease required the construction of remedial works, the function of the Commission was to be consultative only. But in other cases, where the local causes required for their removal, not construction of works, but good administration and the proper carrying out of sanitary rules and regulations, the functions of the Commission would be administrative also.

All orders of the Government of India in respect to sanitary measures within the Bengal Presidency would issue in the usual manner through the Local Governments, but the Supreme Government would exercise through the Commission a general supervision and control over the whole sanitary service. Practically, the Commission would form a Department of Public Health, and the responsible administrative head of this Department would be the President.

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* Military Department Letter of 29th February 1864, No. 1,014.
† The words in *italics* are those actually quoted by the Government of India.

The Commission would apply to the Local Governments upon all matters of sanitary interest, and make suggestions for the consideration of local authorities. But such suggestions would afford no authority for executive action or for expenditure. All civil and military authorities would be requested to afford the Commission every required assistance, and the Commander-in-Chief would be requested to give such orders as would ensure the Commission's receiving promptly from the local military authorities statistical and other information required.

The Commission was to draw up codes of rules adapted to the special sanitary requirements of the Army and of the civil population, to be prepared in communication with the Sanitary Commissions of Madras and Bombay.

The practical work of *executive* sanitary administration would necessarily, as already stated, be carried out by the Local Governments, and by the local civil and military authorities. It would be the duty of the Commission, after careful consideration and communication with those authorities, to submit to the Government of India plans for carrying out and supervising the whole sanitary administration in the Bengal Presidency, making use, so far as possible, of existing establishments. The sanitary state of Calcutta was commended to the special notice of the Commission.

5. But the Commission had existed considerably less than two years when the Government of India, under Sir John Lawrence, recommended an entire change in its constitution, a change which, in fact, amounted practically to the abolition of the Commission, and the substitution of a single officer as Sanitary Commissioner, with a medical officer as Secretary.

The grounds on which this change was recommended will be found in Military Letters of the Government of India, of 21st October 1865, and 2nd June 1866. In February 1866, the Government had taken the opportunity of Mr. Strachey's transfer to the Chief Commissionership of Oudh to carry out the change which they had proposed, and nominated to the position of Sanitary Commissioner an officer who, it is believed, had given no previous attention whatever to sanitary questions.

It is not without purpose that these circumstances are here recapitulated, as well as the substance of the fundamental instructions given to the Bengal Commission. But it is unnecessary to continue the history.

6. It is well known that the Royal Commission, in their Report of May 1863, calculated the average death-rate of the European soldiery in India, previous to the period of their own formation, at 69 per mille; a figure which gave rise to some keen controversy at the time, as to its fairly representing the normal condition of the troops during the years then recent; a controversy which need not be revived.

But the Commission then also recorded their opinion that the experience of the Civil Service, of the military officers with that of their wives and children, of the English troops themselves at many stations, and of the Native troops, proved that in the then existing state of India, the mortality of the English troops could be reduced to 20 per mille; * whilst a hope might be cherished that if the time should ever arrive when India should be freed from the general prevalence of malaria due to local causes, the mortality would come down to one half of the rate just named.

The first anticipation has been justified and much more than justified. The decade 1870–79 afforded a mean annual death-rate of 19·84, therefore distinctly below that indicated as attainable in existing circumstances; and later reports show a stride towards that lower rate, once anticipated only as a distant possibility, in case of a general improvement in the conditions of the country.

Thus, in the Report for 1886, which is the last which has been received from India, I find the death-rate for that and the three preceeding years to be as stated below,† affording for those four earys a mean rate of 13·3. And though the rate for 1886 is greater than that for the three preceding years, its value is enhanced by the fact that the ratio of invaliding (21 per mille) was unprecedentedly low, so that the *combined* loss from death and invaliding stands in 1886 at 36 per mille, considerably below that of any former year.

Satisfactory as this result is, we must not disregard some aspects of the health of the European force which are less favourable, indicating as they do that evils of a powerful kind have yet to be effectually dealt with. Thus the ratios of *admissions to hospital* as of *daily sick* are considerably higher than they were, as a mean, in the decade 1870–79, or in any one year since 1881, and they are, indeed, but little below those of 1878, and of those immediately following years, when widespread and long-continued famine had so injuriously affected a large part of India, and when the employment of a large force in Afghanistan had placed so considerable a part of the European Army under conditions exceptionally unfavourable.

The increase in the ratio of *admissions* may possibly be due in part to greater attention being now given to ailments which were formerly disregarded; but it is more likely to be connected with the increased proportion of young soldiers, due to recent changes in the conditions of service. In any case it is unsatisfactory to find that notwithstanding the constant efforts made to guard their health, the annual admissions to hospital in India amount to 150 per cent. on the numerical strength of the European army; and that 71 out of 1,000 men are always sick.

* Original Report, p. xxix, and pp. lxxxi–lxxxii.

	Death-rates per Mille.		Death-rates per Mille.
† 1883	10·88	1885	14·55
1884	12·56	1886	15·18

7. Such ratios render it imperative on those who are responsible for the health of the Army to spare no effort, whether in discovering the causes of so great an amount of illness, or in removing or mitigating these causes when ascertained.

As regards some particular forms of disease, the statistics do not favour the belief that material improvement in the conditions affecting their prevalence has been effected. The ratio of deaths from enteric fever is shown to be on the rise in each of the three Armies, and in some parts of India intermittent fever would appear (unless the apparent increase be due to altered nomenclature) to have seriously increased of late years. In any case the death-rates from all forms of fever were greatly larger in 1886, in each of the three Presidencies, than the mean rate of the decade 1870–79. As one third of the entire mortality of the Army is due to diseases of this nature, their persistent prevalence and increase cannot but be regarded with anxiety, and no stone should be left unturned in the investigation of the causes of this great evil.

	Enteric Fever, Death-rate per Mille.		
	Bengal.	Madras.	Bombay.
1870–79 - -	2·28	1·42	1·75
1886 - -	5·70	3·85	4·16

	Intermittent Fever, Admission-rate per Mille.			
	1860–69.	1870–79.	1884.	1885.
Gangetic Provinces	269	181	268	382
Meerut and Rohilkund Dewar -	249	433	991	1,289

	All Fevers, Death-rate per Mille.		
	Bengal.	Madras.	Bombay.
1870–79 - -	4·02	2·04	2·89
1886 - -	6·69	4·74	4·43

In regard to this matter also it is possible that the increase is in some measure attributable to the larger proportion of the force which is now constituted by young soldiers. But, if this be so, the duty is none the less imperative that we should ascertain and mitigate the causes which act unfavourably on a class which, from its physical circumstances, is especially liable to injurious influences.

"A young army," the Army Sanitary Committee observes, "involves, as one of its conditions of service, the most rigid attention to every sanitary requirement. The necessity of thorough ventilation, good drainage, dry barracks, the effectual removal of all surface filth, and the improvement of localities by subsoil drainage, has for long been universally admitted; but it is questionable whether there is not room in almost all branches for the more thorough and systematic recognition of their important bearing on the health of a regiment."

8. Diet is necessarily an important element as regards the health of the soldier. On a strong representation from the Army Sanitary Committee this was the subject of special investigation in 1883–85.* The Government of India sent home, as the result of extensive inquiry among medical and commanding officers, the opinion of the Commander-in-Chief, Sir Donald Stewart, that no action on the part of Government was required, and this was communicated to the Army Sanitary Committee. The latter body, however, return to the subject in a recent Memorandum,† in dealing with the subject of enteric fever :—

"Pointed attention was . . . called by the Royal Commission of 1859, and frequently since then by ourselves, to the whole question of dietary, with a view to its being arranged more in conformity with the ages and peculiar conditions of Indian service. Quite recently, indeed, the present dietetic system has been assigned, by an experienced medical officer, as a predisposing cause of enteric fever."

On referring back to the correspondence of 1883–85 it will be seen that, though there was a great difference of opinion among the authorities consulted, a large majority considered the present system unobjectionable, and the then Secretary of State, though (it would appear) not without hesitation, acquiesced, and did not again address the Government of India on the subject. It was, however, admitted generally, and expressed by his Excellency Sir Donald Stewart, that the mutton-ration of the soldiers was poor in quality, and the Government of India stated that they had directed the attention of the Commissary-General to this point.

Again, I find, among the papers connected with this subject, extract from a resolution of the Government of Bombay‡ in the Military Department, which appears to me to contain excellent good sense, though rather strongly expressed. In this it is mentioned that the sanction of the Government of India had then been obtained to the "issue of a free ration of cocoa to men "quartered in the Ghorpúrí barracks, before going on parade in early morning, or on sentry after "midnight, as an experiment." I have not found any record of the result of this experiment, which *primâ facie* strongly commends itself for adoption. In the return of reports on the subject of diet and daily meals from upwards of 100 officers, which accompanied the India Government's letter of 7th August 1885, above quoted, I can find no one instance of cocoa being supplied.

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* Military Letter, No. 233, of 9th December 1884. See also No. 127, of 7th August 1885.

† Memorandum of the Army Sanitary Committee on the Report of the Sanitary Commissioner with the Government of India for 1885.

‡ No. 760, dated 9th February 1881.

9. Another point of the highest importance is noticed in the same series of papers by the Surgeon-General of Her Majesty's forces at Bombay under the head of "*Clothing and Bedding.*" "It would be a great advantage were proper arrangements in force to allow of the soldier having "a change of clothes when he comes in heated from parade or exercise. As a rule he sits or "lies in the breeze till his clothes are dry, and thus often lays the foundation of an attack "of illness."

This point was also dwelt upon by the Government of Bombay in the Resolution, No. 760, dated 9th February 1881, just quoted. It would be well to know if a recommendation so obviously calling for attention has been followed up, and become a rule general in India.

I may observe, in passing, that in the Bombay Presidency generally it appears to me that the largest general progress in sanitary work has been effected.

10. Another matter which calls for attention is the degree in which the health of troops is affected by the local conditions of the country in which they are stationed, and of the population by which they are surrounded. The same circumstances which operate prejudicially upon the inhabitants generally can scarcely fail to exercise an unfavourable influence upon the troops, though in a less pronounced degree. A striking instance is afforded by the case of Lucknow, where the fever death-rate of European troops for 1885 is especially high, viz., 4·7 per mille. This fact derives significance from the high rates of fever mortality in the vicinity, viz., 29 per mille in the city, and 26 per mille in the district. It is improbable that any amount of precaution can secure for troops who are stationed in unhealthy localities immunity from the pernicious influence. Where, therefore, it is necessary to keep a force at any particular spot subject to such influences, it is required in the interest of the garrison, even apart from that of the general population, to improve the drainage and general sanitation of the surrounding country as much as possible. This subject will require further notice.

11. There is another matter which has from time to time already engaged the attention of the Government, and which has assumed increased importance owing to the larger number of young men now in the ranks of the Army, I mean the practicability of locating larger numbers of troops at hill stations, whilst endeavouring by all means to secure the most beneficial result from that location.

It is satisfactory to see the advance that has been made in this measure. The percentages of the whole force of European soldiers resident in the hills during the three last hot seasons, and of their women and children during the last two, were as follows:—

	Men.	Women.	Children.
1885	27·00	No percentage available.	
1886	28·85	37·57	43·32
1887	31·23	43·01	46·55

There can be no doubt that the condition of troops at a hill station, where due provision is made for sanitation, is superior as regards health, vigour, and efficiency to that of troops which pass the hot season in the plains, and while the changed character of the Army as to age renders location in the hills more desirable than ever, the progress in railway construction renders it more feasible.

In 1886 the death-rate of men quartered in the hills was unusually high for the locality (10·2 per mille), though considerably below the general death-rate of the European force in Bengal (15·52).

Many of the deaths constituting this rate were doubtless the consequence of disease contracted in the plains; but it is very questionable whether all that is practicable has been done to remove the cause of disease at hill stations. I observe that, out of 5,455 men of the Bengal force at such stations, there were no less than 169 cases of enteric fever, and 32 deaths from that disease, giving rates respectively of 31·0 and 5·87 per mille. Such rates suggest the probability of some sanitary defect in conservancy or water supply. Hill stations are especially liable to pollutions of soil or of water-supply; and we must not spare pains to remedy these evils at places which we maintained as sanataria.

12. I must now refer to one of the most serious and perplexing subjects of all that touch the health of our European force and its efficiency—that of venereal diseases. There is no need to enter into particulars on this matter at present, for orders have been issued for the rescission of the Contagious Diseases Act.

An able and laborious paper on this subject has been written by Mr. Barclay, Secretary to the Sanitary Commissioner with the Government of India.

The most powerful argument for the suspension of 1884 was drawn from the general fact on the face of the statistics that, in spite of the existence of the Act, the rates of admission for diseases of this nature had, during the operation of the Act, as a whole, instead of descending, risen greatly. Those who were satisfied that the Act should be maintained, in face of the very considerable and respectable body of opinion and sentiment which denounced it, found themselves in great measure disarmed by such statistics. It could hardly, indeed, be urged seriously that the effect of the Act was to increase the prevalence of the diseases. But Dr. Barclay has done much to clear up the anomaly, by producing evidence that the tide of increase has been due to causes which have, in

fact, overborne and swamped the considerable measure of mitigation which the steps taken under the Act had at last produced. I need not make further reference to the subject now for the reason already given. I will only say that nothing affecting the health of the troops calls more urgently than this for action, if beneficial action can be suggested. The immense proportions of the evil must greatly affect the efficiency of the troops, whilst its nature is degrading to their character. No duty can be more incumbent, whilst I fear none is more difficult, than that of abating this mischief.

There seems no question that the influence on this matter of permission for marriage, on the larger scale formerly prevalent, acted for good indirectly as well as directly. At the time of the Royal Commission of 1859–1863, the question of augmenting the ratio of permitted marriages, even as it then stood, was much discussed. Most unfortunately the change which has since taken place in terms of service has led to reduction instead of augmentation in that ratio, and it is difficult to see how an opposite course could be taken under a system of short service.

The remarks of the Royal Commission, in their Report of 1863,* are as applicable now as they were then, only, after a quarter of a century's experience, instead of being in a better position, we seem to be in a worse. Outside of the question of Acts and Regulations, no endeavour promising any influence in mitigation of this great evil should be neglected. Such are, the ample provision of occupation more or less vigorous, and of amusement for the soldier's hours of leisure; voluntary classes in gymnastics, such as are enthusiastically adopted by the men elsewhere; gardening, *when practised by the men with their own hands;* the endeavour to introduce some recreations of a refining and elevating tendency; encouragement to abstinence from strong drink; the endeavour to bring to bear the influence of commanding officers; the greatest care in selection of schoolmasters, and of such chaplains at military stations as seem to have really the character and ability to gain influence over the soldier. It is satisfactory to see the Government of India's Military Letter No. 219, of 29th November 1887, regarding the provision of better regimental accommodation for recreation and refreshments, with its enclosures. The latter are full of valuable suggestions; and one is glad to see the proposal to abolish for the future the daily dram, as well as the general concensus of opinion in favour of temperance societies in the army.

13. Improvement in the health of the wives and children of soldiers has also kept pace with that of the men themselves. The death-rate of children is, however, still higher than it ought to be, and attention should be directed to the determination and mitigation of the causes. Every suggestion tending to facilitate the stay of children in the hills should receive favourable consideration.

In the Native Army the ratio of admissions and daily sick is less than in the European force. The death-rate, however (19·46 for the year 1886), must be regarded as high when we consider the age and circumstances of the class in question, and it suggests the existence of unfavourable hygienic conditions. Such conditions are probably to be found in undrained subsoils, bad hut accommodation, insufficient ventilation, unsuitable clothing, &c. There are, probably, few Native stations in which there is not room for improvement in some of these particulars.

14. The high rates of mortality in certain Indian jails have often been the subject of unfavourable comment; and I regret to observe that in some of the Bengal jails these high rates continued during 1885 and 1886,† indicating the active presence of unhealthy conditions. In the case of Rajshai, cholera contributed in the year 1885 a ratio of 21 per mille to the general mortality, but in this case and others the abnormal unhealthiness is explained by such well recognised and familiar causes as bad drainage, within and without, subsoil soakage, inferior water, overcrowding, defective ventilation, marshy exhalations, the vicinity of low wet land, and the like. The bad water at Delhi is mentioned as contributing to the unhealthiness of the jail, as it does, no doubt, to that of the troops. Though there have undoubtedly been cases in which the origin of an excessive mortality in jails has been difficult to trace, the general causes of the prevalence of disease in jails are now well known, and there should rarely be difficulty or delay in their removal. The results which may be obtained by judicious action are shown in the case of the Madras jails, which present a mortality less than half that of Bengal jails.‡ Indeed, one jail, that of Salem, with 399 inmates, shows the extraordinarily small mortality of 2·52 per mille. Such rates are probably not attainable in other parts of the country, and among populations less robust, but the difference is remarkable, and might with advantage be investigated with reference to the rate in Bengal. Such a phenomenon as a mortality of 170 per mille (which occurs at Jalpaiguri) must be *prima facie* discreditable to prison administration, and ought to provoke thorough investigation, with the determination to remove the causes of such an intense condition of unhealthiness.

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* P. lxii.

	Deaths in some Bengal Jails per Mille.	
	1885.	1886.
† Jalpaiguri	170	65
Dinagepore	151	127
Rungpore	116	61
Rajshai	163	90

	Death-rates per Mille.	
	1885.	1886.
‡ Bengal jails	38	32
Madras „	17	17
Bombay „	33	30

15. Less us now turn to questions affecting the sanitary condition of the general population.

In reviewing sanitary questions affecting the general population, some doubts necessarily arise as to the accuracy of registration, especially when note is taken of the wide range of diversity in provincial and district rates. Five millions of deaths were registered among the 197½ millions of Indian population under registration in 1885, and if we take account of the considerable addition which must be made to this return for unregistered deaths, the probability is that the mortality of India is not much less than double that of England. The questions arise, (1) how far this is due to causes which it is within human competence to remove; and (2) whether, being within such competence, it is practically within the power of our administration to remove or largely to mitigate them.

Much of the Indian mortality is, it may be conceded, attributable to climatic circumstances; in some tracts to great variations of temperature, hot days alternating at certain seasons with cold nights; in some to the exposure of enormous areas emerging from flood, or to a saturation of soil, conditions well calculated to affect unfavourably a population poor in resources, and little able to fortify itself against any external influence. The inhabitants of a country so circumstanced, earning a bare subsistence by agricultural toil, will certainly be subject to much disease and to a high mortality. On the other hand, the people of India are, to a large degree, exempt from the classes of disease to which hard winters, overcrowding, overwork, drunkenness, and destitution give rise in this country. As a matter of fact, the health of the population, when measures of sanitation such as have now become usual in England are carried out, has usually become very much the same as in England. The facts regarding the army, European and Native, which have been cited in former parts of this paper, afford examples of what sanitation will do in checking disease and death. The parts of Calcutta which have been supplied with proper drainage and pure water have a lower death-rate than London. Disease, which once produced a rate of mortality, the blame of which was laid chiefly upon climate, has been shown by the greatly improved health of the educated Anglo-Indian population to have been really a matter most largely dependent on evil personal habits and evil sanitary conditions. Such facts make it difficult to doubt that a great proportion of the disease and mortality of India is due to causes which are largely mitigable by human effort, if we can bring it to bear.

16. The Army Sanitary Committee, quoting the statistical aggregate of deaths and the diseases to which they are ascribed, observe (Blue Book, "Report on Sanitary Measures," &c., vol. xix., p. 166):—

"We learn from this table* that above 78 per cent. of the entire registered mortality was due to mitigable or preventable diseases, and, moreover, that the sanitary problem in India is precisely what it has always been, namely, the executive removal of epidemic and endemic local disease causes, ... towards the extirpation of which" (they proceed a little farther on) "every civilised country has been labouring in past times, with the result stated in the Report of the Royal Commission (of 1863), that, 'whole regions of the earth which were formerly devastated by fevers, 'pestilences, and dysenteries have long since been free from them, except in the milder forms in 'which they now occasion part of the ordinary mortality.'"

During the last ten years, they go on to point out, an aggregate of some 38 millions has been carried off in India by diseases of this class (as shown below),† whilst, it must be remembered, every one of these deaths represents numerous cases of sickness, and, on a low calculation, the fever deaths would represent, in fever attacks during the decade, the entire population of India several times over, besides all the loss of working power which fever attacks entail.

17. What, then, are the particular insanitary conditions which present themselves in India as fostering epidemic diseases? and what is the administrative action directed towards their removal or alleviation which is within the power of Government? The first question is much more easily answered than the second.

The insanitary conditions may be summarised as (1) impure water-supply; (2) imperfect removal of filth and polluted surface; (3) a subsoil either polluted by the continual infiltration of surface impurities, or saturated with moisture and unrelieved by drainage.

These conditions may be said to prevail almost everywhere, except in cantonments and in a few great cities where large engineering projects have recently been carried out. The municipalities generally have made some efforts towards improved conservancy, but, even had their efforts been more general and more successful than I imagine to be the case, they represent but a fraction of the population.

Diseases.	Total Registered Deaths in 1885.
* 1. Cholera	385,928
2. Small-pox	80,630
3. Fevers	3,336,239
4. Bowel complaints	293,638
5. Injuries	83,262
6. All other causes	937,903
	5,177,600
Total of the first four diseases	4,096,435

Epidemics.	Deaths.
† Cholera	3,233,374
Small-pox	1,655,848
Fevers	30,205,020
Bowel complaints	2,962,432
	38,046,674

With regard neither to the municipalities nor to the rural population can our administration, I think, allow the present state of things to continue without a well considered effort seriously to combat its mischiefs.

On this point we are assured of the concurrence of the Government of India. In commenting on the sanitary reports of the Bengal and Madras Governments for 1885, they express the opinion that the time has now come for the prosecution of sanitary measures on a more systematic plan than has hitherto been adopted as a rule.* It is pointed out that recent legislation has endowed local bodies with very considerable powers for the sanitary improvement of towns and villages, and has placed at their disposal considerable sums for expenditure on that object; that it is of the utmost importance that the money thus rendered available should be laid out to the best advantage on well devised schemes of permanent utility, and, with a view to this, it is suggested that a sanitary survey of each municipality in the provinces should, with as little delay as possible, be undertaken by the Sanitary Commissioners and by the local engineering authorities, that plans and estimates should be prepared of all improvements necessary to provide each town with an efficient system of drainage, water-supply, and conservancy, and that the plans so fixed should be executed from year to year as funds become available, the object aimed at being persistently kept in view, till it is completed; the Government of India meanwhile being kept informed of the progress made from year to year in carrying out the policy thus recommended for adoption.

18. No doubt the instructions given above are far in advance of the general feeling and knowledge prevalent in most municipalities on the subject of sanitation. To take the case of the Madras municipalities, for instance, it may be observed that, out of a municipal expenditure of 15½ lacs, "the expenditure on drainage works amounted to Rs. 19,853, and that on improvement of the "water supply to Rs. 40,091 only. Drainage operations were confined to the municipalities of "Coconada, Madura, and Tinnevelly, and the Committees appear to have generally failed to adopt "regular and comprehensive schemes for the improvement of the drainage and the supply of good "water."

To take another instance, we see that in the Central Provinces the neglect of municipalities to pay attention to sanitary matters, to exercise supervision, and to enforce rules, has attracted the unfavourable notice of the Government of India. Evidence to like effect might be supplied from the proceedings in other provinces. The sums devoted to conservancy and structural improvements are in almost every instance so inconsiderable as to show that next to nothing is being attempted.

19. On the whole, whilst there can be no question of the necessity of the sanitary surveys which the Government of India proposes, it must be doubtful if much practical result can be expected, until two needful matters are provided, viz., (1) the advice and aid of experts; (2) greater facility in procuring funds for the objects desired.

(1.) As to advice and aid from experts. Constructive measures of sanitation, as of drainage (both surface and subsoil) and water supply, frequently present very serious difficulties and involve for successful execution, much skill, knowledge, and experience. In this country very large amounts have every year, for the last quarter century, been laid out in undertakings of this nature, and there has grown up a class of experts, possessed of high professional qualifications, varied experience, and familiarity with every detail of such projects. Even in England, however, differences of opinion still exist among professional engineers as to the manner in which filth of towns and their surface and subsoil water can be best removed. In India there is, I apprehend, very little of such experience, and no class of engineers who can be said to have scientific acquaintance with sanitary practice. Moreover, the conditions differ so widely from those which prevail in this country that no unmodified copy of English practice will suffice to meet the problems which frequently demand solution. Great expenditure would be wasted if local bodies were stimulated or permitted to embark on projects of improvement which had not been thoroughly well considered by engineers possessed of a well grounded knowledge of the principles of such works and a large practical experience in their execution. When therefore orders are given for the making of sanitary surveys, and for working out remedial measures which such a survey shall show to be necessary, it becomes essential that there should be some authority within reach possessing the necessary qualifications for giving advice that carries weight, able to frame projects when required, and competent to guard public bodies from wasteful or mischievous mistakes.

It can scarcely be said, I apprehend, that any such authority does now exist in India. The Sanitary Commissioners have, as medical men, no professional acquaintance with engineering; the local engineers may or may not have had any experience of this branch of work, and in any case only very exceptionally.

On such grounds one is disposed to regret that the nucleus of a consultative Sanitary Commission and Board of Health, such as was set up in 1864, was allowed so speedily to be abolished. It may or may not have been a very efficient instrument during its short life, but it is difficult to believe that, if it had continued to exist, and under the presidency of a gentleman of the ability and knowledge of its first head, it would not have developed into a valuable and progressive agency, which by this time would have left a deep mark in the sanitary improvement of the country.

20. I should hesitate, however, in spite of the advantage that might be anticipated from a judiciously formed body of experts, to urge upon the Government the reconstitution of a Com-

* Proceedings of the Government of India in the Home Department for July 1887. Municipalities.

mission (rather of Commissions) of the nature referred to, especially as their cost would trench somewhat largely upon the funds that may be available for executive improvement. But it may be gravely doubted whether the various public bodies, on which the sanitary improvement of India so largely devolves, will be found competent to carry out such important sanitary measures as are contemplated unless there be at least available in each of the Presidencies and greater provinces, for advice, direction, and review, an engineer of recognised experience in this especial branch of work. Without such an authority at hand, it would most certainly be necessary that projects of any considerable importance for the supply of water and for town sewage should be sent home for submission here to a consulting engineer of experience and reputation; a course which would involve, possibly, great delay, and very probably a large and unprofitable expenditure of labour and money, in the preparation of projects eventually condemned as unsuitable.

Necessarily a consulting sanitary engineer, employed as has been suggested, should be at liberty to visit and inspect personally the sites of proposed improvements of importance; but he would no doubt be able likewise to employ assistant engineers, of ordinary training, under his instructions, to report on local projects, and to work out their details.

21. Let us turn now to the second essential point which has been named, and which presents greater preliminary difficulties; I mean the provision of funds.

The pressure upon the Provincial Governments, and upon all local bodies, for funds to meet various important demands, is no doubt at this time severe.

As regards the provision of funds to municipalities having such work to carry out, it may be observed that the Act XI. of 1879 appears to have marked a change of policy in respect to the grant of loans from Government to local bodies; and this practice has, I understand, been, since then, for the most part, discontinued, though it is not clear, on the comparison of that Act with the Act XXIII. of 1871, which it superseded, why that should have been a necessary consequence. I understand, however, that the practical result has been to throw municipalities, desirous to borrow for works of improvement, upon the open Indian money-market, and that serious difficulties are experienced by such bodies in raising loans at all, even in cases where their credit may be regarded as good. The Calcutta municipality, for instance, has, I see, been considerably hindered in the most necessary task of completing its water-supply by the difficulty experienced on various occasions in raising funds. It is obvious that the financial difficulties with which the Government has to deal renders impossible its committing itself to supply funds to numerous public bodies simultaneously, or on any scale definitely prescribed beforehand. But if it is the case that the terms obtainable by municipalities in the local market are so onerous as to be to them practically prohibitory, whilst the Government could obtain money to certain amounts on much better terms, which it could lend to the municipalities at such rates of interest as to afford the Government a margin of profit, the benefit of such action would be hardly questionable, provided all the rules which are prescribed under the Acts alluded to are observed. And as it is impossible, from the necessary limitation of means of every kind, that the reforms which we desire to stimulate should be undertaken simultaneously on any considerable scale, the course suggested might be facilitated by the annual determination of a limit to the permitted aggregate of such loans; effort and expenditure being directed with persistence, in the first instance, to sanitary improvement at some of the most important points where disease can be traced directly to bad or scanty water-supply, or to some notorious defect in the arrangements for the removal of sewage.

Where there is, as is in very many instances the fact, a British garrison in close vicinity to the town, the resources of the civil authorities ought to be supplemented by a grant from the Military Budget, on condition that the cantonment participates in the benefit of the work. The protection of the principal towns and cantonments in this way will be a step of importance towards the diminution of the force and prevalence of the epidemics that so gravely affect the health of our army and of the great cities.

22. As regards rural sanitation, it may be recognised that the case is even more difficult to deal with. But it is quite as pressing that in this field also a step in advance should be taken without delay, at least in those elementary reforms which consist in the securing of wholesome water by the protection of wells for drinking from the infiltration of impurities, and the protection of the surface from general pollution. It is probable that even when funds are provided for carrying out such elementary reforms in villages, it will be necessary to consider well what means may be made available for securing their right execution, and the proper disposal of the money assigned for it. This is a matter to which the consideration of the Local Governments should be especially drawn.

To provide funds for such operations one would never suggest the introduction of loans, for which the local Boards would practically have no security to offer, whilst the district funds, though available for appropriations to sanitary objects, have demands upon them which leave amounts available for such objects very small, and sure to be granted only with reluctance, Here, again, I can only repeat that an initiative is what we expressly require, and that it would be well to concentrate what assignments can be made by the local Boards upon limited areas, and so to proceed gradually. At the same time the Local Governments would thus be able, and should make it an especial object, to assign grants in aid to local Boards for such purposes distinctly defined.

23. It has been seen from the statistics of many years that the great enemy of health in India is fever; and there seems little room for doubt that the prevalence of this disease in all its varieties, particularly in Northern India, is very largely and intimately connected with saturation

of the subsoil; whilst I fear there is hardly more room for doubt that the multiplication of our engineering works, canals, roads, and railroads, so beneficial in some respects, has tended to promote this evil, both by the great addition of moisture and raising of the subsoil water-level, caused by the canals, and by the obstruction to general spontaneous surface-drainage caused by the embankment. Besides many other statements that might be cited, the report for 1885 of Mr. Planck, Sanitary Commissioner of the North-Western Provinces, refers prominently to effects produced by such conditions on the health of the population of the Doab; and in the Despatch (Statistics and Commerce, No. 45) of 31st March 1887, Lord Cross drew especial attention to the typical case of the town of Shamli, in the Northern Doab, noting it as a case which it was desirable to deal with experimentally and thoroughly, and with a view to obtain practical knowledge as to the application of remedial measures in such circumstances.

This is a matter which, as a Government, it seems to me, we are bound to treat to the best of our ability, and, unless the Local Governments take it up with serious concern and persistency, things will go on deteriorating. One is, indeed, unwilling to speak so strongly as might be done with justice on this subject, but it may at least be said that a far larger share of the funds assigned to the Irrigation Department in all parts of the Gangetic valley should be for years devoted to the draining of the soil and the mitigation of this great cause of the characteristic disease of India, malarial fever. If extensive mischief, such as I refer to, has really been produced by a system of irrigation which yields a large revenue to the State, there is a distinct obligation to spare no pains in the endeavour to remove it. And in this case there should be less difficulty about funds, for the canal budgets could bear an allotment for serious works of drainage, whilst the Canal Department presents on the spot a number of skilful and thoroughly experienced engineers. This is a matter demanding the attention not only of the Government of the North-Western Provinces, but that of Bengal also in connexion with the Behar irrigation.

24. Neither should any other means be neglected by which the great object of ameliorating the health of India may be promoted; one of which is the persistent circulation of manuals in the different vernaculars containing suggestions for the guidance both of municipalities and of those who may be expected to take any part in the sanitary reform of villages. In these indications of a detailed kind should be given of the manner in which, with the (perhaps humble) means at command, the inhabitants may most efficiently protect their health from local causes of disease. Several such manuals have, indeed, been printed and circulated. And Mr. Bellew's "Dialogue on Sanitary Matters," which was printed at Lahore in 1880, appears to have been an eminently meritorious effort in this direction. It is pleasant also to see it stated in the Report for 1883–84 that one of the native municipal commissioners of Poona was preparing a vernacular pamphlet, designed to spread among his countrymen information of the kind required. But such measures are apt to slacken, and one would gladly be assured that the diligent circulation of such instructive matter is persevered in.

I do not know to what degree instruction in sanitary principles is given in schools and colleges; a matter not to be neglected, but one which all experience assures us will be neglected, unless it be persistently enforced.

Further, it is unquestionable that much good may be done by personal influence when the chief civil officer of a district or a subdivision takes a hearty interest in the subject, and shows this in his intercourse with the people. Forcible remarks on this matter, by the Government of India, are quoted in the Report for 1883–84 (Blue Book, Vol. XVII.), p. 200, as follows:—

"There is no doubt much truth in these remarks (viz., as to the difficulties to be encountered), but it is equally true that if district officers really interest themselves in the matter, a great deal can be done by their influence and judicious guidance to improve the surface drainage of villages, to set apart and preserve in good order tanks or wells for providing pure water to the villages, to keep clean the compounds and surroundings of houses, and to provide accommodation for keeping cattle, as well as for latrine purposes, at a distance from human habitations. It is of the highest importance that the conditions under which the people live should be regarded as most intimately connected with their happiness and prosperity, and that it should not be set aside as a theory which is practically impossible."

A good impression in this way once made is likely to become durable, for, when such a reform has been fairly initiated in a locality, it has been found, I believe, that the people themselves come to appreciate the good of it. And when such interest is shown, and such results are reaped, the local Government might well give substantial expression to their value for such service rendered by officers under their authority.

As examples of what is here alluded to, I may indicate the action which appears to have been taken in the Banda District, North-Western Provinces, and by the Deputy Commissioner of Baraitch district, in Oudh, as referred to by the Army Sanitary Commission in the Report of Sanitary Measures in India in 1881–82 (Blue Book, Vol. XV.), p. 228.

25. It will be apprehended, I trust, that there is in the remarks of this paper no disposition to under-estimate the difficulties of the task which we have taken upon us. It may be said to involv almost the creation of something like a new moral sense among the people of India. It is possi however, that such a creation has already begun, and that it has made more progress than w aware of. And it is well to remember how obtuse were a great part of the people of E 30 or 40 years ago to the great need of sanitary reforms, and even how much in

remains to be done in this country, notwithstanding the much greater facilities for spreading conviction, and the vast amount of amelioration that has been actually effected.*

And when we consider the formidable statistics before us, and above all the apparent tendency to the augmentation rather than the diminution of mortality from epidemic and endemic disease, action by every promising means within our power is absolutely incumbent upon our Government. As regards the mitigable mortality of India itself, fever rather than cholera is the great adversary with which we have to contend; though at the same time we may be well assured that every improvement which diminishes the tendency to fever will also, in great measure, remove that fuel which lies ready to burst into flame on the advent of an epidemic of cholera.

26. We have had reports, statistics, and suggestions for quarter of a century; but, taking a broad view of amelioration in the health of the country, the advance cannot be said to have been other than small. It is absolutely necessary that a new and large step forward should be made.

In addition to the sense of duty as a pressing motive to such action as we desire, the fact cannot be overlooked that the extensive presence of insanitary conditions in India is becoming yearly a more serious political evil. In these days, when intercommunication between countries, even the furthest apart, is increasing so rapidly, it is never possible to anticipate how far an evil influence of any kind may not spread. And, as a matter of fact, the ill repute of India as an alleged focus of epidemic disease encounters us all over the civilised world.

The reports of the Hygienic Congress at Vienna in 1887 show a turn of the tide of opinion as to the efficacy of quarantine, at least as regards certain high scientific authorities on the continent. But there is no indication, I apprehend, among continental nations that the popular belief in the virtues and the necessity of that system has undergone modification.

Quite apart, however, from that particular question of quarantine, is the allegation that cholera, by whatever obscure law it is diffused, is continually generated in India, and that, whilst, on the one hand, we impugn the benefits ascribed to quarantine, and indicate sanitary reforms, such as we claim to have carried out in our own country, to be the only true barrier to the spread of the disease, we of the British nation in India leave the sanitary reforms of which we speak substantially uneffected.

In these circumstances, I may remark, we have an indisputable ground for maintaining that the gradual but persistent carrying out of local sanitary reforms, and the judgment of the adequacy of the provision made for that object, cannot be left to depend *ultimately* upon the votes of a municipal majority. It is indeed an essential part of the duty of a municipality to carry out such reforms for the benefit of the locality; but the importance of the results of such measures, and the consequences of their being neglected, extend far beyond their local bearings.

I am unwilling to put forward this paper without the addition of some remarks on a subject closely bearing upon its purpose. I refer to the machinery in this country for reviewing sanitary proceedings in India. The mainspring of this machinery was, till recently, Dr. John Sutherland, as the guiding member of the Army Sanitary Committee. But he has now retired from the duties which he so long performed in that capacity.

These duties may be said to have consisted for many years in the preparation of careful and minute reviews of the various sanitary reports, military and civil, that come from India, for the duties connected with military sanitation in England have for a long time been few and exceptional. Dr. Sutherland's reviews have been circulated to the other members, and occasionally small modifications have been suggested, but these also have been few and exceptional. Practically his reviews have been adopted by the committee, and in fact the work of the committee has been his.

When completed and formally adopted by the committee, these reviews have been submitted to the Secretary of State in Council, and forwarded by him, with any remarks that seemed desirable to the Government of India.

The amount of Dr. Sutherland's work in this kind has been immense. But in quality and value it has been as great as in amount.

It is not known—at any rate to the present writer—whether the War Office proposes to continue the existence of the Army Sanitary Committee, or, if it does, what arrangement will be made for carrying on the duties hitherto performed by Dr. Sutherland.

Hitherto, though, as I have stated, the bulk of the work performed for many years past has been Indian, Dr. Sutherland has been a paid employé of the War Office. We cannot expect this to continue; and if Dr. Sutherland's Indian work is to be maintained, that can only be ensured by the India Office undertaking to bear the expense.

I regret to find from the papers before me that high authorities in this Office are disposed to object to the continuance of the work on such conditions.

I trust they will be prevailed on to reconsider this judgment. Technically, of course, if the War Office should not provide for the maintenance of Dr. Sutherland's duties in connection with India, and if the cost of such provision should consequently be undertaken by this Office, this may

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25. is fever varieties,

* *E.g.* One hardly ever hears among one's friends, to this day, of a house taken on lease or purchased, in London, including houses of very recent erection, in which costly work to remedy neglected drainage has not to be undertaken.

be described as creating a new appointment. But it will be, in reality, *maintaining an old appointment,* which has been of the highest value to the British Army, and to the State, in India, and the cessation of which would be a deplorable misfortune.

In ordinary times I should have urged that the maintenance of this appointment (though probably on a considerably reduced scale of remuneration) by Indian revenues should be accepted without hesitation, because, during all these years of its tenure by the wise and admirable old man who has now retired, the appointment has been maintained without charge to India.

It may be argued, of course, that the matter is not important enough, under present financial restrictions, to justify the necessary expenditure. To this I shall presently recur. But it is not, in my judgment, admissable to say, as has been said, that what is suggested is "the objectionable "course of paying from Indian revenues an officer of the War Department."

It is a singular fact that it is the War Department which, in this case, has been paying an officer to do Indian work. As I have already intimated, the work, for many years past, of the Sanitary Committee, apart from its Indian work, has been of insignificant amount; not two per cent., I should guess, of the whole. It is to be recollected that these reviews of the work of the Indian sanitary officers, and of the sanitary state of things in India, have embraced all three Presidencies, and all branches, army, jails, municipal, and rural centres of population, including all the questions connected with registration and statistics bearing on sanitary conditions, whilst they have applied principles to the criticisms of the reports and facts from all, and have made suggestions on all from a central point of view, and with eminent practical knowledge. The reviews and suggestions of Dr. Sutherland, considered and concurred in by his colleagues, have carried great weight and been of high practical value, not merely from their being (as I have said) the only reviews from an independent point of the whole sanitary work and condition of India, but because the subject has even now not got beyond that position in which constant hammering at details, in reviews from a body external to the Government, such as the Army Sanitary Committee, continue indispensable. As I have said in the Minute to which this note is appended, this sanitary business, and the indoctrination of its principles and details, not in India only, but in India *a fortiori,* is like the inculcation of a new moral sense, and as difficult. Let the Secretary of State and the Council cast an eye on one of the volumes containing the reviews in question, and see what they really are, before they come to a decision dooming the machinery which has produced them.

The suggestions made in the papers before me as to the manner in which the duties are to be done, without any one specially appointed (and paid) to do Dr. Sutherland's work, seem to me entirely unpractical. The work requires one man who has the qualifications of an expert, and whose entire duty it should be, or at least who could give a very large and undistracted share of his whole time to do it. Sir J. Fayrer and I have from time to time contributed suggestions or remarks derived from Indian knowledge, in modification of Dr. Sutherland's drafts. But even Sir J. Fayrer, with all his medical science, is not a sanitary expert, much less am I.

It is not possible to make more detailed suggestions on the subject without knowledge of what the War Office proposes for the future constitution and duties of the Army Sanitary Committee. Should that Office determine, as I suppose they well may, to revive the work of the Committee in reference to the Army at home and in the colonies, it is highly improbable that it would consent to commit the review of sanitary proceedings in those fields to an Indian sanitary officer. It is therefore conceivable that the course most expedient would be to have two reporting officers on the Committee, one appointed by the War Office and one by the India Office, the reviews of Indian sanitary proceedings falling to the latter to draft. But in the present stage I need not prosecute this matter further. The object of this Note is simply to urge the retention of an effective and paid expert on the Army Sanitary Committee for the review of Indian proceedings, in the manner so long and so usefully followed by Dr. Sutherland. If this link, which has hitherto existed between Indian sanitation and home criticism, be lost, I believe that the course of improvement will be checked, and that we shall also greatly risk the commencement of a retrograde course, not only as regards the health of the country, but even as regards the health of the troops.

HENRY YULE, Colonel.

10th December 1888.

REPORT

ON

SANITARY MEASURES IN INDIA IN 1888–9.

VOL. XXII.

Presented to both Houses of Parliament by Command of Her Majesty.

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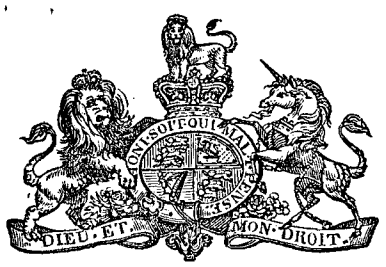

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CONTENTS.

REPORT.

	Page
I. European Army:	
Sickness and mortality in 1888	1
Cholera	2
Small-pox	2
Fevers	3
Bowel complaints	3
Venereal diseases	3
Invaliding	3
II. Native Army:	
Sickness and mortality in 1888	4
Bengal	4
Madras	6
Bombay	6
III. General Population:	
Vital Statistics	7
Bengal	7
North-Western Provinces and Oudh	9
Punjab	10
Lower Burma	11
Central Provinces	12
Assam	12
Madras	13
Bombay	14
Berar	15
IV. Jails:	
Sickness and mortality in 1888	17
Bengal	17
North-Western Provinces and Oudh	18
Punjab	19
Burma	19
Central Provinces	20
Assam	20
Madras	20
Bombay	21
Berar	21
V. Vaccination:	
General results	22
Bengal	22
North-Western Provinces and Oudh	22
Punjab	23
Lower Burma	23
Central Provinces	23
Assam	23
Madras	24
Bombay	24
Berar	24
VI. Medical Institutions:	
Civil Hospitals and Dispensaries:	
Bengal	25
North-Western Provinces and Oudh	26
Punjab	26
Lower Burma	27
Central Provinces	27
Assam	27
Madras	28
Bombay	28
Berar	28
Lock Hospitals:	
Bengal	28
North-Western Provinces and Oudh	29
Punjab	29
Lower Burma	30
Central Provinces	30
Madras	30
Bombay	31
Lunatic Asylums:	
Bengal	31
North-Western Provinces	32
Punjab	32
Lower Burma	32
Central Provinces	33
Assam	33
Madras	33
Bombay	33
Medical Schools:	
Bengal	34
North-Western Provinces and Oudh	34
Punjab	35
Madras	35
Bombay	35
VII. Sanitation:	
Civil:	
Bengal	37
North-Western Provinces and Oudh	37
Punjab	38
Lower Burma	38
Central Provinces	39
Assam	39
Madras	39
Bombay	40
Berar	41
Military:	
Bengal	41
Madras	41
Bombay	41

ABSTRACTS.

	Page
India Sanitary Report for 1888:	
European troops	45
Native troops	61
Jails	68
General population	77
History of chief diseases	80
Vaccination	91
Sanitary works	93
General remarks	96
Madras Sanitary Report for 1888:	
Vital statistics	99
Chief diseases	101
Sanitary works	103
Personal proceedings and General remarks	105
Bombay Sanitary Report for 1888:	
Vital statistics	107
Chief diseases	109
Vaccination	110
Sanitary works	112
Personal proceedings and General remarks	113
Calcutta Municipal Report for 1888	116
Calcutta Health Ditto	120
Bombay Municipal Ditto	125
Bombay Health Ditto	128

A. GODLEY,
Under Secretary of State.

INDIA OFFICE,
15th July 1890.

REPORT.

I.—EUROPEAN ARMY.

Sickness and mortality in 1888.

The health statistics of the European troops in India during 1888 were not apparently so favourable as in the previous year. Of an average strength of 68,887, the admissions into hospital were in the ratio of 1,382 per 1,000 against 1,370 in 1887, the daily sick rate 71 or 1 per 1,000 more, and the death-rate 14·84 against 14·20. Compared with the decennial average of 1870–79 the mortality in 1888 was 4·50 per 1,000 lower. The loss by invaliding was 23 per 1,000, the same as in 1887, bringing the total loss by death and invaliding to 38 per 1,000, an increase of 1 per 1,000 on the ratio of 1887. The increase in sickness and mortality was attributed to the inclusion, for the first time, of the statistics of troops serving in Upper Burma. Omitting these, the health statistics of 1888, the Sanitary Commissioner with the Government of India says, would probably have compared favourably with those of 1887.

The proportions in which each of the Presidency Armies contributed to these results as compared with the previous year were as follows :—

Presidency.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total loss.
Bengal	1887	40,601	1,426	69	14·83	19	33
	1888	42,858†	1,398	71	15·47	20	36
Madras	1887	11,725*	1,250	77	12·96	31	44
	1888	14,147†	1,341	77	15·55	28	43
Bombay	1887	11,188	1,292	67	13·23	28	41
	1888	11,882†	1,372	67	11·70	25	37
India	1887	63,514*	1,370	70	14·20	23	37
	1888	68,887†	1,382	71	14·84	23	38

* Excluding troops on active service in Burma.
† Excluding troops in Burma for the first three months of the year.

In all three armies there was more sickness than in 1887; the mortality was also higher, except in the case of the Bombay Army, which recorded a lower death-rate by 1·53 per 1,000. The improvement in this Army was due to a diminution in the mortality from cholera, the death-rate from other diseases having slightly increased. In the whole Indian Army cholera, small-pox, ague, remittent fever, enteric fever, heatstroke, dysentery, hepatitis, spleen diseases, and venereal diseases contributed higher admission-rates than in 1887. Of the above, venereal affections and ague were the cause of about half the total sickness, the former contributing 26·82 per cent., and the latter 22·89. Enteric fever continued to head the list of death causes, cholera following, though the mortality from each (3·75 and 1·99 respectively) differed but slightly from that of the previous year.

Bengal Army.

In the Bengal Army the admission-rate fell from 1,426 per 1,000 in 1887 to 1,398, but the daily sick-rate increased from 69 to 71 per 1,000, and the death-rate from 14·83 to 15·47, and this notwithstanding that cholera was less fatal. The increase in the death-rate was due chiefly to respiratory diseases, apoplexy and heatstroke, hepatitis, and enteric fever. Of the seven geographical groups into which the Bengal Army is divided, four returned a higher admission-rate than the average rate of the Presidency, viz., Agra and Central India group 1,748 per 1,000, Meerut and Rohilkund 1,682, Bengal Proper 1,621, and the Punjab 1,421. In the other three groups, the Gangetic Provinces and Oudh recorded an admission-rate of 1,382, the Hill Stations 1,255, and Quetta district 1,140. Four out of the seven groups recorded admission-rates in excess of those of 1887. The average death-rate of the Presidency was exceeded in three groups, and four returned higher ratios of mortality than in the

previous years. The increase was most marked in the Punjab group, whose rate of mortality rose from 13·63 in 1887 to 16·25, Quetta followed with 13·50 against 11·38, Bengal Proper with 16·05 against 14·17, and the Hill Stations with 14·86 against 12·42. The greatest decrease occurred in the Gangetic Provinces and Oudh group, viz., from 19·01 to 15·01 ; in the Meerut and Rohilkund group the mortality fell from 14·31 to 11·89, and in Agra and Central India from 20·03 to 17·61.

Among the troops serving in the districts of Rajputana, Malwa, Sind, and Aden (average strength 5,848) the admission-rate rose from 1,413 per 1,000 in 1887 to 1,468, while the death-rate declined from 17·10 to 13·34. The improvement in mortality was mainly under cholera, from which there was only 1 death against 23 in the previous years. At each of the three principal stations in this group (Mhow, Karachi, and Aden, with a combined strength of 3,240) there was more sickness than in the previous year with a diminished mortality.

In the Deccan and Nagpur group the ratio of admissions to hospital per 1,000 of an average strength of 9,571 was 1,232 against 1,184 in 1887, and the death-rate was 9·19 per 1,000 against 10·88. The decreased mortality occurred chiefly under cholera, from which there were 6 deaths against 10 in 1887, malarial fevers, and hepatitis; on the other hand enteric fever was more fatal, the ratio of mortality having risen from 3·73 to 4·07 per 1,000. Of the chief stations, Secunderabad returned a slightly lower death-rate than in 1887, viz., 11·54 against 12·07 ; the Poona garrison death-rate was 12·37, or 5·16 per 1,000 above that of 1887, and Belgaum recorded a mortality ratio of only 2·61 per 1,000 against 12·56 in 1887.

The Southern India group (average strength 4,332) also recorded a higher admission-rate with a much lower death-rate, the former having risen from 1,163 to 1,323 per 1,000, and the latter having fallen from 11·36 to 9·00. The increase in sickness was chiefly from ague, small-pox, hepatitis, and respiratory diseases, and the decrease in mortality was mainly in enteric fever, hepatitis and respiratory diseases. At the large station of Bangalore in this group, with an average strength of 2,228, the admission-rate rose from 798 in 1889 to 1,155 per 1,000, while the mortality decreased from 9·15 to 8·08. At Bellary (average strength 810) there was more sickness with a higher death-rate.

Among the troops serving in Burma (average strength 4,061) the admissions were in the proportion of 1,681 per 1,000, and the death-rate 32·50. Of the 132 deaths in this force nearly a half (63) were from cholera and remittent fever. This being the first time that the statistics of Lower and Upper Burma were combined they cannot be compared with former years.

The health statistics of the troops in the Hill Stations of Madras and Bombay were much more favourable than those of the previous years, the admission-rate having declined from 1,690 to 1,224 per 1,000, and the death-rate from 15·62 to 4·10 per 1,000. There were only 4 deaths in this force, whose average strength was 976, 3 being from hepatitis and 1 from spleen affections.

Cholera.

Of the chief diseases, cholera prevailed more extensively among the European troops in India in 1888 than in 1887. The admissions to hospitals from the disease numbered 207 or 24 more, and the deaths 137 or 10 more; the ratios of 1888 (3·0 and 1·99 respectively) were almost exactly the same as those of 1887, owing to the increased strength of the Army in the year under report. The majority of the deaths occurred among the troops in the Bengal Command, viz., 90, being 2 less than in 1887. Out of the seven groups of stations in this Command, two (Agra and Central India and Quetta district) were free from the disease, and in the Meerut and Rohilkund group there was only one case and no death. Of the other groups, Punjab recorded a cholera death-rate of 3·35, Bengal Proper following with 2·29, Hill Stations with 2·08, and the Gangetic Provinces and Oudh with 1·34. More than a third of the cholera deaths in the Bengal Army occurred at the Rawalpindi Station.

In the Madras Army there were 49 cases of cholera with 40 deaths, the latter being in the proportion of 2·83 per 1,000 of strength; but of these, only 2 cases and 1 death occurred in the Presidency Proper, the troops on service in Burma having contributed the remainder. In the Bombay Army there were only 10 cases and 7 deaths, and of these 7 and 5 respectively occurred among the troops stationed at Poona.

Small-pox.

In the European Army of India as a whole, the small-pox cases numbered 111, and of these 10 proved fatal against 40 cases and 2 deaths in 1887. Eight of the deaths occurred in the Bengal (five at Lucknow Station) and 1 each in the Madras and Bombay Armies.

Intermittent fever was slightly more prevalent among the European troops in 1888 than in 1887, the admissions from it being in the ratio of 316 per 1,000 of average strength against 300. It was also more fatal, 11 deaths having been recorded, an increase of 4 on the mortality of the previous year. Only in the Bengal Army were the admissions lower than in the previous year, but all the deaths were contributed by Bengal and Madras. In both the mortality was greater than in 1887, the increase in the case of Madras being due to the inclusion of the statistics of Upper Burma. **Fevers.**

From enteric fever the admissions rose from 806 or 12·7 per 1,000 in 1887 to 938 or 13·6, and the deaths from 239 to 258, the death-rate (3·75) being the same in both years. Of the three armies, Bengal recorded a mortality under this head of 4·15 per 1,000 against 4·09 in 1887, Madras 2·26 against 2·98, and Bombay 4·04 against 3·40. As regards the relationship between enteric fever and age, the year's returns continued to show that the mortality was by far the greatest among young soldiers. Of those who died from the disease, 5·46 per 1,000 were under 25 years of age against 5·37 in 1887, whilst for men between 25 and 29, and from 30 to 34, the mortality was only 2·36 and 0·84 respectively. The percentage of liability to the disease among soldiers at the above ages was 61·21, 26·46, and 9·42. The liability not only diminishes with age, but in a more marked manner with prolonged residence in the country, for during the year under report the death-rate among men of less than two years' residence was 6·39 per 1,000, among men of three to six years 2·77, and only 1·08 among those who had been in the country from seven to ten years.

In the beginning of 1889 the Government of India appointed a Committee to inquire into the alleged increase of enteric fever in the army in India. The investigation was mainly confined to the state of affairs in the Bengal Army, and the general results arrived at by the Committee will be found in the Abstract of the Sanitary Commissioner's Report, pp. 50 to 57.

The admissions from dysentery and diarrhœa were in the proportion of 67 per 1,000 of strength against 73 per 1,000 in 1887, and the death-rate was 0·74 against 0·71. Dysentery was more prevalent only in Bengal than in the previous year, and diarrhœa only in Madras; but the mortality from both dysentery and diarrhœa increased in Madras, and was as usual higher than in Bengal and Bombay. Diarrhœa, though less prevalent in Bombay in 1888 than in 1887, was slightly more fatal. **Bowel complaints.**

More than a fourth (27 per cent.) of the admissions to hospital were from venereal diseases, and the ratio per 1,000 of strength was 371, or 10 per 1,000 above the admission-rate of 1887, and 18 per 1,000 less than that of 1886. The increase was confined to the Bengal and Bombay armies, as in that of Madras the ratio declined from 400 to 376 per 1,000. In the Bengal Army the admission-rate rose from 356 to 373, and in the Bombay Army from 337 to 357. "In the last three years," the Sanitary Commissioner remarks, "much greater pains than formerly have been taken "to discriminate between venereal and non-venereal affections in all possibly doubtful "cases (*e.g.*, inflammation and suppuration of the inguinal glands, stricture, warts, "&c.). This has tended to lower the amount of venereal shown in our tables, so that "a high ratio now means more than in former years: it would, that is, have been "still higher under the old system." **Venereal diseases.**

The loss to the whole army by invaliding during 1888 amounted to 1,557 men, equal to 22·71 per 1,000 of strength, against 1,443 men or 22·57 in 1887. The proportion of invalids to strength was as usual least in Bengal (20·43 per 1,000) and highest in Madras (27·84), that of Bombay being 24·82; but Bengal was the only case in which the ratio exceeded that of the previous year. The percentage of those invalided as unfit for further service was 39 or 2 per cent. higher than in 1887. As regards the influence of age and length of residence in India upon invaliding, 46·58 per cent. of the number were under 25 years of age, against 49·41 in 1887, while 29·01 per cent. had been less than two years in India, and 52·11 per cent. had from two to five years' service. Half of the strength of the European army in India during 1888 was under 25 years of age, and 76 per cent. had not more than five years' Indian service. Of the total number invalided 81·12 per cent. had been less than five years in India. **Invaliding.**

II.—NATIVE ARMY.

Sickness and mortality in 1888.

The health of the Native Army of India as a whole was favourable in 1888. There was less sickness than in the previous year, but the death-rate was 1·24 per 1,000 higher.

The ratios of sickness and mortality of each section of the Native Army of India for 1887 and the previous year are given in the following table :—

		Average Strength.	Ratio per 1,000 of Average Strength.			
			Admissions.	Daily Sick.	Deaths.	Total Deaths, including Absentees.
Bengal Native Army	1887	42,586	1,057	35	12·63	19·95
	1888	50,886	992	33	13·11	16·62
Madras ditto	1887	20,031	772	32	11·53	22·22
	1888	25,671	886	36	15·31	20·10
Bombay ditto	1887	20,353	1,092	34	11·50	15·45
	1888	23,570	1,080	35	10·52	13·37
Corps of Central India and Rajputana	1887	5,305	755	20	7·16	8·40
	1888	5,233	658	17	5·54	6·07
Punjab Frontier Field Force	1887	11,961	1,687	38	11·87	14·88
	1888	12,426	1,369	36	15·61	18·18
Hyderabad Contingent	1887	5,018	614	20	9·16	12·66
	1888	6,242	734	27	6·73	10·94
INDIA	1887	105,254*	1,045	33	11·68	18·17
	1888	124,822†	995	33	12·84	16·14‡

* Excluding men on active service in Burma.
† Including Upper Burma for the last nine months of the year.
‡ Including deaths in Upper Burma in the first three months of the year.

As usual the Central India Irregular Force and the Hyderabad Contingent were the healthiest branches of the Native Army. The Punjab Frontier Field Force was the unhealthiest; but taking into account absent deaths the troops in the Madras Command returned the highest death-rate.

The chief cause of sickness was ague, the admissions from which were in the proportion of 473 per 1,000, or a decrease of 38 per 1,000 on the ratio of 1887. The admission-rates from cholera, small-pox, dysentery and diarrhœa, and venereal diseases showed an increase, and those from fevers and respiratory diseases a decrease. The chief death causes were respiratory diseases and cholera, the former accounting for 335 deaths or 2·68 per 1,000 of strength against 324 or 3·08 in 1887, and the latter 267 or 2·14 per 1,000 against 138 or 1·31. From enteric fever the death-rate was only 0·06 per 1,000, as compared with 3·75 the ratio of the European troops. From other fevers the Native troops suffered more than the European troops. "It would appear," the Sanitary Commissioner with the Government of India states, "as if the Native "were actually less susceptible to enteric fever than the European—a circumstance "more easily explicable on a climatic theory of causation than on a pythogenic one. "No reason has ever been suggested why the Native soldier should suffer less severely "than the European from a filth disease. But the Native soldier lives as he always "has done since he was born; whereas the European has been transported to a "climate totally unlike that in which he had hitherto lived, to an ardent climate, "without a corresponding change in his diet, and with a great deal of change of habit "and of adaptation to new surroundings to be gone through."

Bengal Native Army.

The results of the Native Army of Bengal were satisfactory, the admission and daily sick-rates being less than in any year since 1883, while the death-rate was very little higher, and was accounted for by the inclusion for the first time of the statistics

of Upper Burma. Respiratory diseases, though slightly less fatal than in 1887, still caused the highest proportion of deaths (3·03 per 1,000). From cholera there were 90 cases, 71, or nearly 80 per cent., of which proved fatal. In the previous year there were 108 cholera cases with 64 deaths among the Bengal Native Troops. Dysentery and diarrhœa also contributed a greater number of deaths, and the death-rate under this head rose from 1·49 per 1,000 to 2·04.

The following statement gives the principal statistics of the regular troops in Bengal, arranged in geographical groups, for 1888 and the preceding year :—

		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam	1887	5,654	1,462	61	14·32
	1888	6,273	1,107	41	18·81
Gangetic Provinces	1887	5,970	906	30	7·54
	1888	6,684	830	31	8·08
Rohilkund and Meerut	1887	5,282	1,258	44	21·39
	1888	6,672	998	34	10·19
Agra and Central India	1887	3,826	1,220	42	8·36
	1888	5,270	1,171	39	9·11
Punjab	1887	20,436	894	25	10·33
	1888	21,284	789	24	10·05
Quetta District	1887	642	1,545	54	68·54
	1888	1,133	1,337	40	22·07

Of these six groups, Quetta district held the first place in both sickness and mortality, though it will be seen that the statistics show a great improvement on those of the previous year. All the groups recorded lower admission-rates than in 1887; but the mortality in three, viz., Bengal Proper and Assam, the Gangetic Provinces, and Agra and Central India, was greater. The increase in the first of these three groups was due chiefly to respiratory diseases and diarrhœa, in the second to respiratory diseases and dysentery, and in Agra and Central India to remittent fever, dysentery, and respiratory diseases. Of individual stations in the Bengal Command four recorded death-rates exceeding 20 per 1,000 against eight in 1887. These were Moradabad with 53·19, Alipore and Ballygunge with 23·11, Quetta with 21·40, and Shillong and outposts with 20·56.

Punjab Frontier Force.

With a decrease in sickness among the troops comprising the Punjab Frontier Force there was a much higher death-rate than in 1887, which was due to an increased mortality from cholera and respiratory diseases. Of an average strength of 12,426 the admissions to hospital were in the ratio of 1,369 per 1,000 against 1,687 in 1887, and the deaths 15·61 against 11·87 per 1,000. The decrease in sickness was most marked in ague, dysentery, and respiratory diseases. Still respiratory diseases were the principal causes of mortality, and the number of deaths rose from 59 or 4·94 per 1,000 to 80 or 6·44. Cholera came next with 45 deaths, equal to 3·62 per 1,000 against 19 or 1·59.

Corps of Central India and Rajputana.

The health of the corps of Central India and Rajputana (average strength 5,233) was even more favourable than in the previous year. The admission-rate declined from 755 to 658 per 1,000, and the death-rate from 7·16 to 5·54. From all the chief diseases the admissions were fewer, and the troops were free from cholera. Respiratory diseases and hepatitis were the principal death causes; the former accounted for 28 per cent. of the total mortality, and the latter 10 per cent. At no station was the admission-rate above 1,000 per mille, and in no regiment did the death-rate exceed 10 per 1,000.

Hyderabad Contingent.

Among the troops composing the Hyderabad Contingent there was increased sickness with a much lower mortality in 1888 as compared with the previous year. Of an average strength of 6,242 the admission-rate was 734 per 1,000 and the death-rate 6·73, against 614 and 9·16 respectively in 1887. Ague was the chief cause of sickness,

causing 42 per cent. of the total admissions, and the principal causes of death were cholera and respiratory diseases, from each of which there were 6 deaths. The highest station death-rate was 17·39 at Amraoti, but this was the result of only 2 deaths.

Madras Native Army.

The health returns of the Madras Native Army for 1888 were materially affected by the inclusion of the statistics of the troops on service in Upper Burma. The ratio of admissions to hospital per 1,000 of an average strength of 25,671 was 886 against 772 in 1887, the daily sick-rate was 36 or 4 per 1,000 more, and the death-rate rose from 11·53 to 15·31 per 1,000. Including the deaths of men absent from their regiments on sick leave and other causes the death-rate of 1888 was rather lower than that of 1887, viz., 20·10 against 22·22. The greatest increase of admissions occurred under cholera, ague, remittent fever, and bowel complaints. Ague was the cause of 37 per cent. of the total admissions and bowel complaints 7 per cent. Cholera was the principal cause of mortality, and the deaths rose from 30 or 1·49 per 1,000 in 1887 to 107 or 4·17. Of these 76, equal to 18·12 per 1,000, occurred among the troops in Upper Burma. There was also an increased mortality from remittent fevers and bowel complaints, while on the other hand respiratory diseases were slightly less fatal. None of the stations of the peninsula had a death-rate over 20 per 1,000, and in none of the old established Burma stations did the mortality exceed 13 per 1,000; while the Upper Burma stations as a group returned a death-rate of 49·58 per 1,000.

Bombay Native Army.

The health of the Bombay Native Army in 1888 was very good. Of an average strength of 23,570 the admissions to hospital during the year were in the proportion of 1,080 per 1,000 against 1,092 in 1887, the daily sick-rate was 35 or 1 per 1,000 more, and the death-rate was 10·52, just 1 per 1,000 less. The decrease of sickness was principally in respiratory diseases, and in a less degree in all fevers except ague, diarrhœa, rheumatism, spleen diseases, &c. Ague caused 39 per cent. of the total admissions, and bowel complaints 8 per cent. Respiratory diseases and cholera were the chief death causes, the latter was much more prevalent, and the deaths increased from 14 in 1887 to 37, half of which, equal to 32·53 per 1,000 of strength, occurred among the small body of Bombay troops on service in Burma. From respiratory diseases the mortality was considerably below the previous year, viz., 59 or 2·50 per 1,000 against 90 or 4·42. In none of the old stations in the Bombay Command did the death-rate reach 20 per 1,000, and in the majority it was below 10 per 1,000; but among the troops stationed in Upper Burma the mortality reached 85·62 per 1,000.

III.—GENERAL POPULATION.

Vital statistics.

Births were registered throughout all the provinces of India in 1888 excepting Lower Bengal where birth registration was still confined to selected areas. Their number is, however, being gradually increased year by year, and in 1888 had risen to 134, an increase of 34 on the number of the previous year. Of the principal provinces the best results were again obtained in the Central Provinces and in Berar, in both of which the birth-rate exceeded 40 per 1,000; it was over 38 per 1,000 in the Bombay Presidency and the North-Western Provinces and Oudh; it exceeded 37 per 1,000 in the Punjab, and in the remaining provinces it varied between 16·61 in Coorg and 31·62 in Assam. In nine out of the eleven provinces the birth-rate exceeded the death-rate, the exceptional cases being Lower Bengal and Coorg, the registered mortality in the former being in excess of the births by 4·64 per 1,000 and in the latter by 2·79. The registered deaths amounted to 5,087,138 or 25·74 per 1,000 of population under registration, being 2·61 per 1,000 lower than the ratio of 1887. By provinces the death-rate ranged between 30·08 per 1,000 in the North-Western Provinces and Oudh and 17·30 in Mysore. The decrease in mortality was shared in by eight provinces, the most striking case being that of Berar whose death-rate declined from 45·33 to 24·75 per 1,000. Of the chief diseases cholera was much less prevalent than in 1887, and the deaths fell from 475,675 or 2·40 per 1,000 to 269,862 or 1·36. The decrease, however, was confined to four provinces, for in Assam, the Punjab, and the Madras and Bombay Presidencies the mortality from the disease was much greater than in the previous year. Small-pox was more prevalent and accounted for 93,568 deaths, equal to 0·47 per 1,000 of registered population, against 65,757 or 0·33 in 1887. The increase was shared in by all the principal provinces except Bombay. Fevers gave rise to 3,374,685 deaths or 17·07 per 1,000 against 3,584,876 or 18·12, and from bowel complaints the deaths numbered 252,200 or 1·27 against 291,745 or 1·47 per 1,000.

The deaths from the chief diseases and from all causes in the several provinces were as follows:—

	Cholera.		Small-pox.		Fevers.		Bowel Complaints.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1888.	1887.
Bengal, excluding Calcutta	111,391	1·68	6,247	0·09	1,092,102	16·53	52,086	0·78	1,515,735	22·94	23·46
Calcutta	1,734	4·00	12	—	3,198	7·38	1,056	2·43	11,685	26·97	25·34
North-Western Provinces and Oudh	18,704	0·42	25,000	0·56	1,053,753	23·89	52,288	1·19	1,327,113	30·08	35·86
Punjab	14,938	0·79	16,938	0·90	379,893	20·16	18,626	0·99	563,229	29·89	34·31
Lower Burma	15,982	4·37	571	0·16	36,391	9·96	6,459	1·77	85,486	23·40	16·18
Central Provinces	921	0·10	10,729	1·22	158,195	17·94	17,618	2·00	253,061	28·70	32·70
Coorg	2	—	66	0·37	2,730	15·31	310	1·73	3,461	19·41	19·41
Assam	9,693	2·14	2,059	0·45	71,825	15·87	14,726	3·25	126,654	27·98	24·52
Madras	58,677	2·10	21,858	0·78	204,561	7·34	27,721	0·99	597,015	21·43	21·67
Bombay	36,500	2·22	3,617	0·22	304,449	18·50	45,462	2·76	468,043	28·44	27·67
Berar	305	0·11	817	0·31	29,979	11·44	9,987	3·82	64,865	24·75	45·33
Mysore	1,015	0·25	5,654	1·38	37,609	9·19	5,861	1·43	70,791	17·30	18·59
Total	269,862	1·36	93,568	0·47	3,374,685	17·07	252,200	1·27	5,087,138	25·74	28·35

Bengal.

As in previous years the registration of births in Lower Bengal in 1888 was confined to selected areas. Out of a total of 148 municipal towns 134, with a population of 2,615,716, recorded births, the ratio per 1,000 being 20·63, which is a slight improvement on 19·35 the birth-rate of 100 towns in 1887. This result is, however, far from satisfactory, and points to imperfect registration, which is further shown in the excess of deaths over births in the towns by 4·64 per 1,000. The registered mortality for the whole province was in the ratio of 22·94 per 1,000 against 23·46 in the previous year, the total number of deaths being 1,515,735 or 36,793 less than in 1887. The defective state of registration is also shown in the great variation in the district death-rates, which ranged from 13·46 in the Sonthal Pergunnahs to 42·49 in the Suburbs

of Calcutta. The attention of the local authorities has been directed annually to the importance of improving the registration, but the instructions appear to have been practically disregarded. The Lieutenant Governor has again issued a circular which he hopes will have the effect of stimulating the energies of municipal bodies.

Of the chief diseases cholera was much less severe than in 1887, though it was present in every district. The deaths decreased from 172,578 or 2·60 per 1,000 in 1887 to 111,391 or 1·68. At the fairs and festivals there was very little cholera, the great majority escaping altogether. Dr. Gregg, the Sanitary Commissioner, in his report for 1888, gives a diagram showing the prevalence of cholera in the province for 15 years, and the inferences to be drawn from it are—that the year under notice compares favourably with nine out of the total; that, as a rule, the province is comparatively free from cholera during the earlier months of the year; that the disease prevails with much severity in the hot weather before the rains set in; that there is a comparative lull during the rains; and that it appears again in the cold weather, but not to the same extent as in the hot weather. Of all the districts the Suburbs of Calcutta suffered most, recording a mortality of 10·27 per 1,000, followed by Chumparun with 6·62 against 7·50 in 1887, and Maldah, Backergunge, and Manbhum with over 4 per 1,000 each. In the case of Chumparun, the Civil Surgeon attributed the outbreak to overcrowding of the cultivators in April for the opium weighments at Motihari, where the sanitary arrangements were defective and the water-supply was impure. With a view to prevent a repetition of the epidemics he made several recommendations, among them that future weighments should be carried on outside municipal limits, and that the sites should be selected with special reference to water-supply. The Government intended communicating a copy of the Civil Surgeon's report to the Board of Revenue and requesting them to make arrangements for carrying out, as far as possible, the Civil Surgeon's proposals.

Small-pox was more prevalent than in the previous year, and the deaths rose from 3,846 or 0·05 per 1,000 to 6,247 or 0·09. Of these over 80 per cent. were of children under 12 years of age. This high rate, Dr. Gregg reports, is in a great measure due to the difficulty experienced in some districts in inducing parents to have their children protected even in the face of severe epidemics. All the districts recorded deaths except Bogra. Those most affected were as usual in the Patna and Orissa divisions. The greater part of the Patna division being unprotected by vaccination the Lieutenant Governor thought it advisable that the provisions of the Vaccination Act should be extended to the whole division, and he has directed the Sanitary Commissioner to submit a report on the subject.

The deaths recorded as from fevers rose from 1,087,768 or 16·44 in 1877 to 1,092,102 or 16·53. In his remarks on fevers, Dr. Gregg points out that they, especially malarial fever, ought to be more dreaded than cholera. "The annual "death-rate from fevers," he says, "is nearly three-fourths of the entire death-rate "of the province, or more than twice as much as the death-rate of all the other "diseases put together; and when it is remembered that every death from fever "probably represents 20 or more attacks, it may be imagined what a very large "proportion of the population must have suffered. During the year under review "the death-rate from fever in Bengal was 72·05 per cent. of the total death-rate of "the province, and the number of persons who suffered from the disease was probably "21,842,040 out of a total population of 66,055,695. These facts are very alarming, "and point to the urgent necessity for something being done at least to mitigate, "if it is impossible entirely to prevent, this disease, which exercises such a terrible "influence on the health and prosperity of the people." As regards the seasonal incidence of fever, the last three months of the year show the greater prevalence, when the soil is saturated with water after the rains; and the excessive mortality is attributed chiefly to the want of proper drainage. "The drainage of many districts," Dr. Gregg observes, "has already become, or is fast becoming, obstructed for the "want of sufficient waterway in its roads and embankments, and by the silting up of "its natural and artificial outlets, the result being a water-logged condition of the "soil and the production of fever." It is noticed in the Government Resolution on Dr. Gregg's report that the action of nature tends constantly in a flat country like Bengal to silt up the khals and so waterlog the country drained by them, and that "under the guidance of such a Sanitary Board as the Government of India have "proposed a beginning might be made towards remedying these evils."

Under bowel complaints 52,086 deaths were registered, equal to 0·79 per 1,000 of the population, against 56,893 or 0·85 in 1887. Of individual districts, the Suburbs of Calcutta, Darjeeling and Balasore suffered most, recording death-rates of 6·39,

5·68, and 4·84 respectively, and in five other districts the mortality exceeded 2 per 1,000. "There can be no doubt," Dr. Gregg states, "that the prevalence of bowel "complaints is prominently due to climatic influences acting on the poorer people, "who for the most part sleep on the ground, wear wet and insufficient clothes, and "drink impure water. It is also in a great measure brought about by errors of diet "and inordinate eating after partial starvation."

The general health of Calcutta was slightly less favourable than in the previous year, the total mortality having risen from 10,979 or 25·34 per 1,000 of population in 1887 to 11,685 or 26·97. Still the rate compares favourably with the decennial mean of 28·7. The increased mortality was chiefly due to the rise in cholera deaths from 1,198 or 2·76 per 1,000 in 1887 to 1,734 or 4·0. There was also a slight increase in small-pox deaths from 2 to 12. On the other hand the fever mortality was the lowest that has been recorded, the deaths numbering 3,198 or 7·38 per 1,000 against 3,253 or 7·50 in 1887. The deaths from bowel complaints also declined from 1,197 or 2·76 per 1,000 to 1,056 or 2·43.

North-Western Provinces and Oudh.

The results of the registration of vital statistics in the North-Western Provinces and Oudh during 1888 were far from satisfactory. Notwithstanding that in the previous year the Local Government issued a circular directing the special attention of all district officers to deficient registration, the recorded births in 1888 were less than in 1887 by 21,296, the number having declined from 1,708,735 or 38·74 per 1,000 to 1,687,439 or 38·25. The Lieutenant Governor intended to issue fresh orders insisting on prompt attention being given to registration. The births, however, exceeded the deaths by 360,326 or 8·16 per 1,000.

The year was, comparatively speaking, a healthy one, and on the whole free from epidemic sickness. There were registered 1,327,113 deaths, yielding a ratio of 30·08 per 1,000 against 1,581,739 or 35·86 in 1887. The variation in the district ratios was not so great as in the previous year, ranging from 19·29 in Ballia to 48·42 in the Tarai, against extremes of 23·37 and 71·59. Excluding the notoriously unhealthy district of the Tarai, only three districts returned death-rates exceeding 40 per 1,000 as compared with 17 districts in 1887. It would seem that, apart from the question of deficient registration, the inhabitants of villages were much healthier than those of towns; and this in spite of the condition of the villages being such that it "could "hardly be worse." "The small size of the villages," Dr. Richardson, the Sanitary Commissioner, says, "their wide dispersion over the country, their freely ventilated, "though poor, huts or houses, and the larger proportion of the lives of their inhabitants "passed in the open air, more than compensate for the absence of the advantages "secured to the dwellers in towns by systems of sanitation more or less inefficiently "carried out." Nearly 45 per cent. of the year's deaths occurred among children under five years of age.

Cholera was remarkably little prevalent, the mortality being less than a tenth of what it was in 1887. The deaths numbered 18,704 or 0·42 per 1,000 against 200,628 or 4·54 in 1887. Only in the districts of Benares, where cholera is said to be endemic, Bahraich, Basti, Gonda, Kheri, and Fyzabad, did the mortality reach 1 per 1,000, while four districts enjoyed complete immunity from the disease. All the great fairs held during the year were free from cholera, which the Lieutenant Governor states was due largely to the precautions taken by the Sanitary Department, and only 2 per cent. of the villages were affected against 17 per cent. in 1887.

Small-pox, on the other hand, was considerably more fatal, the deaths having increased from 8,492 or 0·19 per 1,000 in 1887 to 25,000 or 0·56. About two-thirds of the deaths were contributed by the districts of Oudh, in most of which vaccination is extremely backward. It appears that while the average annual mortality from small-pox in the North-West scarcely exceeds 1 per 1,000, and in many district falls much below this, the mortality in most of the Oudh districts ranges from 3 to 5 per 1,000.

Fevers were credited with more than three-fourths of the total deaths. The number recorded in 1888 was 1,053,753 or 23·89 per 1,000 against 1,136,496 or 25·76 in 1887. By districts the Tarai as usual headed the list with a death-rate of 43·95, Moradabad following with 34·39, and six others with ratios of over 30 per 1,000, while only in 10 districts was the fever mortality below 20 per 1,000. The rainfall of the year was in excess of the average in nearly all the districts, and fever mortality increased generally, though in some of the canal irrigated districts it was below the average for the last 5 years. "Excess of moisture in the soil," Dr. Richardson states, "however caused, is "productive of malarial diseases; it matters little whether this excess is the consequence

" of rainfall, inundation by rivers, or irrigation by canals, and in each case the remedy " is drainage."

From bowel complaints 52,288 deaths were recorded, being in the proportion of 1.19 per 1,000 of population, against 70,145 or 1·59 in 1887. But, as Dr. Richardson points out, little reliance can be placed in these figures when contiguous and altogether similar districts record death-rates widely different. Kumaon, for instance, recorded 5·96 and Garhwal 11·52; Banda 1·76 and Hamirpur 8·03. "It is obvious," he says, " that the difference must be due more to the agencies employed to record the diseases " than to difference in the incidence of the diseases themselves."

Punjab.

The registration of vital statistics in the Punjab during 1888 does not appear to have been carried on so successfully as in the previous year. The number of registered births fell from 732,648 or 38·88 per 1,000 of population to 703,113 or 37·32, this ratio being the lowest recorded since 1883. The decrease was spread over 20 of the 31 districts of the province. Sialkot district returned the highest birth-rate of 53·46, and nine other districts recorded ratios ranging between 40 and 49 per 1,000. As usual the frontier districts returned very low birth-rates, especially Simla and Peshawar, viz., 13·02 and 17·10 respectively. The Local Government has directed the attention of all frontier district officers to the necessity of taking steps for improving the system of registration. The total number of deaths registered in the province during 1888 was 563,229 or 29·89 per 1,000 against 646,384 or 34·31 in 1887. This decrease, however, the Government of India attributed more to defective registration than to improvement in the public health, for both cholera and small-pox were very prevalent; and they hoped that more attention would be given to the important subject of registration of vital statistics. Just a fourth of the deaths (140,750) occurred among children under one year of age. Delhi was the most unhealthy district, returning a death-rate of 42 per 1,000; Ferozepore came next with 38·55, followed by Shahpur with 38·41 and Gurgaon with 38·23; in 11 other districts the mortality varied between 30 and 36 per 1,000, and in the remainder between 18 and 29 per 1,000. It is observed that 18 districts showed higher rates of female mortality than male, while there were only three districts (Jullundur, Amritsar, and Ferozepore) in which the mortality among female children under one year of age exceeded that of male children of the same age. The Government of India considered that the high death-rate of females merited a local inquiry with the object of ascertaining its causes.

Of the chief diseases, cholera was much more fatal than in any year since 1867, excepting 1879. The deaths numbered 14,938 or 0·79 per 1,000 against 8,804 or 0·47 in 1887. Ten districts were exempt from the disease, and those which suffered most were comprised within the Rawalpindi and Derajat divisions. Shahpur district, in the former division, recorded 3,924 fatal cases, yielding a death-rate of 9·31 per 1,000. A curious feature noticed by the Officiating Sanitary Commissioner, Dr. Roe, with regard to the epidemic was the exemption of the chief towns. "Considering the large " population in them," he states, "the slight incidence of the disease in the 15 " which were attacked (the total deaths being only 727) is very remarkable, and it " would seem to indicate that their sanitary condition is better than formerly." On the outbreak of the disease in each district precautionary measures were at once taken by the authorities to prevent its spreading by the employment of medical subordinates and members of the vaccination staff in distributing medicine, and otherwise rendering aid to the sick.

The mortality from small-pox was again very high, the deaths amounting to 16,938 or 0·90 per 1,000, being 556 above the number recorded in 1887. All the districts were affected, and in many it assumed an epidemic form causing more deaths than cholera. Children suffered very severely, no less than 14,951 of the deaths being of children under twelve years of age. The Sanitary Commissioner considers that the practice of inoculation has much to do with the spread of small-pox, though it appears to be much less practised of late years except in the frontier districts. "To suppress " inoculation altogether," he says, "is doubtless difficult, as it is a regular trade with " some who have practised it for years as their fathers did before them, and nothing " short of legislation for the imposition of penalties will put it down."

The mortality from fevers was considerably less than in 1887, the deaths having declined from 447,994 or 23·78 per 1,000 to 379,893 or 20·16. The districts which returned the highest death-rates were Delhi (29·45), Gurgaon (29·41), Ferozepore (27·22), Gujranwala (25·01), Karnal (24·0), and Gurdaspur (23·79), these having been the chief sufferers in the previous year. The continued prevalence of fever in these districts was attributed to the swampy or water-logged condition of the country.

"The Lieutenant-Governor," it is stated in the Government Resolution, "is fully "impressed with the conviction that one of the greatest benefits that could be "conferred on the country would be to carry out an efficient system of drainage in "those water-logged and unhealthy tracts. Most of the projects would involve a large "expenditure of funds, and must be undertaken only after mature consideration. "Our efforts, however, in the way of improving the sanitary condition of the rural "population ought, in his Honour's opinion, to be chiefly turned in this direction, and "the projects above alluded to will receive the strongest support he can accord to "them. These are, in fact, as the Lieutenant Governor has frequently had occasion "to say, the best and safest measures of village sanitation that can be proposed. "The attention of District Boards should continue to be drawn to this subject, and it "should be distinctly understood that the Government will not refuse, when feasible "and satisfactory projects have been prepared, to help their execution by grants in "aid or by facilitating loans on terms which can be afforded."

Bowel complaints were the cause of 18,626 deaths, a decrease of 5,912 on the number registered in 1887, the death-rate being 0·99 per 1,000. These figures, however, are not very reliable, for it is stated that, as malarial fever is so often accompanied by dysentery or diarrhœa, if either of these complaints should happen to predominate, the death resulting is undoubtedly attributed by the friends to the disease which was most noticeable, although in reality it was only a result of the fever.

Lower Burma.

Owing to the disturbed state of the country, the collecting and recording of vital statistics in Lower Burma in 1886 and 1887 were attended with great difficulty, and the results were far from satisfactory. With a return to order the record of 1888 bears evidence of improvement in registration. The report of the Sanitary Commissioner deals with Lower Burma only, but the Chief Commissioner has requested him in future to furnish statements as far as possible of Upper Burma.

The number of registered births in Lower Burma rose from 79,420 or 21·74 per 1,000 in 1887 to 87,350 or 23·91 in 1888, this ratio being made up of extremes ranging from 11·91 per 1,000 in Toungoo district to 35·06 in Sandoway. On the whole the year 1888 was unhealthy, but improvement in registration partly accounted for the increased death-rate. The registered deaths amounted to 85,486 or 23·40 per 1,000 as compared with 59,115 or 16·18 in 1887, the district ratios varying between 10·25 in Mergui and 50·72 in Thayetmyo. The imperfectness of registration is further shown in the birth-rate of the province exceeding the death-rate by only 0·51 per 1,000. With a view to the proper registration of births and deaths rules were framed by several municipalities under the Burma Municipal Act, 1884, and it is hoped that district officers will give their close attention to the subject.

Under all the chief diseases more deaths were recorded in 1888 than in the previous year. From cholera the mortality was the highest on record, the deaths numbering 15,982 or 4·37 per 1,000 against 2,649 or 0·73 in 1887. The epidemic was most severe in the four districts of the Irrawaddy division, and in the Tharawaddy and Prome districts of the Pegu division, where 13,848 of the deaths occurred. Of these six districts, Thayetmyo returned a cholera death-rate of 22·01 per 1,000, Tharawaddy 9·11, Thongwa 8·51, Bassein 5·82, Henzada 5·48, and Prome 4·08. The rural tracts suffered the most, the towns having recorded only 1,757 of the 15,982 deaths. Out of a total of 14,811 villages 17½ per cent. suffered from the disease.

From small-pox 571 deaths were registered against 228 in 1887. Six districts were entirely free from the disease; in four the deaths were below 10; while Shwegyin, Bassein, and Pegu contributed more than two-thirds of the mortality. The great majority of the deaths (439) occurred among children under 12 years of age.

Fevers were more fatal in Lower Burma during 1888 than in any previous year, and the deaths rose from 31,825 or 8·71 per 1,000 in 1887 to 36,391 or 9·96. The largest number of deaths was returned by the Pegu division (11,401), and the highest death-rate was recorded by the Arakan division (14·78). The majority of the deaths occurred during the latter half of the year, July, August, and September being the most fatal months.

Bowel complaints caused 6,459 deaths or 1·77 per 1,000 against 2,424 or 0·66 in 1887. More than a third of the mortality was contributed by Tharawaddy district. It is noticed that in this district all the registration circles, and about 61 per cent. of the villages, returned deaths from this cause, while in the province as a whole only about half the circles and 13 per cent. of the villages registered deaths. These results, the Government of India observe, indicate very great variation in the system of recording deaths, and they commend themselves to the Local Government.

Central Provinces.

The general health of the Central Provinces during 1888 compares favourably with the previous year, though in some districts the poorer classes suffered on account of scarcity of food. The results of the registration of births bear indications of improvement, the number of recorded births having risen from 354,501 or 40·20 per 1,000 in 1887 to 366,050 or 41·52. By districts the ratios varied from a minimum of 33·02 in Burhanpur to a maximum of 47·39 in Nimar. In all the districts there was an excess of births over deaths, the ratio for the province being 12·82 per 1,000.

There was a diminished prevalence of all the chief diseases except small-pox, and in the case of fevers and bowel complaints this was attributed to the early cessation of the rains and to the total rainfall being below the average. But the great disproportion between male and female deaths throughout the province as a whole, and the reported bad state of health in some districts owing to the scarcity of food grains are considered by the Sanitary Commissioner with the Government of India to throw some doubt on this view. The total registered deaths numbered 253,061 or 28·70 per 1,000 against 288,325 or 32·70 in 1887. Fourteen of the 20 districts shared in the decrease, while even in the remaining six the increase was not very great. The decrease was most marked in Wardha, whose death-rate (24·70) was 20·25 below that recorded in the previous year, the improvement being attributed to the less prevalence of fevers and cholera; Sambalpur also returned a lower death-rate (23·22) by 17·77 per 1,000; and in two other districts (Narsinghpur and Damoh) the mortality was nearly 15 per 1,000 less.

The year was remarkably free from cholera. The death-rate (0·10 per 1,000) was the lowest recorded since 1880, except that of 1884 (0·02), and was considerably below the average of the five years 1883–87, which was 1·53 per 1,000. The deaths numbered 921 against 12,576 or 1·43 in 1887, and were spread over nine districts, the great majority (757, equal to 1·55 per 1,000) being returned by Hoshangabad district. All the jails were exempt from the disease in the year under notice, as were also the large fairs of Birman and Ramtek.

On the other hand small-pox was much more fata than in 1887, the deaths having risen from 3,368 or 0·38 per 1,000 to 10,729 or 1·22, and exceeded the ratio of 10 out of the preceding 15 years. This result was almost entirely due to a severe outbreak of the disease in Raipur and Bilaspur, where the deaths rose from 690 and 368 respectively in 1887 to 5,074 or 4·44 per 1,000 and 2,345 or 3·08 in 1888. Of the total 10,729 deaths, 9,172 were of children under 12 years of age. The excessive prevalence of the disease was attributed to inoculation. It is also stated that deaths from measles were wrongly returned under small-pox. The Government of India, however, observe that these causes can hardly account for the increase.

Fevers, though less prevalent than in 1887, accounted for much the largest proportion of mortality. The number of deaths registered under this head was 158,195 or 17·94 per 1,000 against 169,326 or 19·20 in 1887 and a five years mean of 18·98 per 1,000. In 14 districts the mortality was less than in 1887, and in six it was greater. The decrease was most noticeable in Wardha, where the death-rate (10·89) was 9·33 below that of the previous year. The highest death-rate from fever was returned by Nimar district (25·62), and the lowest by Sambalpur (6·12).

The deaths recorded as due to bowel complaints amounted to 17,618 or 2·00 per 1,000 against 26,057 or 2·95 in 1887, showing that in 1888 the mortality was nearly a third less. As usual Sambalpur district returned the highest death-rate, namely, 5·07, but it was lower by 7·27 per 1,000 than in 1887. An inquiry into the prevalence of bowel diseases in this district was held, when impure water-supply, defects of diet, and insufficient protection from chills were found to be the chief causes. The decrease in Sambalpur was attributed to some extent to more exact registration.

Assam.

Although the registration of vital statistics in Assam is still far from perfect, the results of 1888 show an improvement on previous years. Among a registered population of 4,526,959 the birth and death rates were in the proportion of 31·62 and 27·98 per 1,000 respectively against 28·59 and 24·52 per 1,000 in 1887. The number of deaths rose from 111,015 in 1887 to 126,654, the increase of 15,639 being attributed chiefly to a higher mortality from cholera, fever, and bowel complaints, and partly to an improvement in registration. By districts the death-rate ranged from 36·69 per 1,000 in Lakhimpur to 24·67 in Nowgong. Excepting Cachar and Goalpara all the districts recorded a higher death-rate than in 1887. Evidence of the defectiveness of registration is given in the returns of the sudder and sub-divisional towns, where, in spite of compulsory registration being in force, the respective birth-rates were 24·29

and 22·70 per 1,000 as compared with 31·62 in the districts. The Sanitary Commissioner, Dr. Costello, reports that little or nothing was done during the year to enforce the provisions of the Compulsory Registration Act. Special measures have, however, been taken to secure better results in future.

Of the total 126,654 deaths, cholera contributed 9,693 or 2·14 per 1,000 of population against 7,941 or 1·75 in 1887. Excepting in Cachar and Silhet districts, where there was a marked decrease in cholera mortality compared with the previous year, the increase was general throughout the province. In the Brahmaputra Valley, the mortality was more than double that of 1887. Nearly 11 per cent. of the total 16,012 villages recorded deaths from cholera.

The Assam immigrant coolies suffered very seriously from the disease. Out of 31,217 coolies who arrived in Dhubri with the view of proceeding up the Brahmaputra, 838 died, 771 from cholera. In consequence of this severe mortality, vigorous steps were taken to prevent a recurrence of it—*see* Abstract of Report of the Sanitary Commissioner with the Government of India, pp. 82 to 84.

From small-pox the deaths rose from 1,162 or 0·26 per 1,000 in 1887 to 2,059 or 0·45 in 1888, the increase being due to the greater prevalence of the disease in Sylhet and Kamrup. In Sylhet there were 1,389 fatal cases against 145 in the previous year. The epidemic was attributed to inoculation, the question of the prohibition of which was being considered by the Local Government. Nowgong district was entirely free from small-pox, as were also all the sudder towns excepting Gauhati and Sibsagar.

The deaths ascribed to fever amounted to 71,825 or 15·87 per 1,000 against 65,105 or 14·38 in 1887. The increase extended to every district excepting Goalpara and Cachar, where there was a considerable improvement, especially in the case of Goalpara, though it recorded the highest death-rate of 28·49 per 1,000 against 34·73 in 1887. In his remarks on fevers, Dr. Costello notices the prevalence of *kala azar*, which is common in the Garo hills and parts of Kamrup. He describes it as a very aggravated form of malarious fever, though there are no proofs of its contagiousness. Owing to the rapid spread of the disease to other districts, he recommended that its cause should be scientifically inquired into. The Government of India state that it seems probable that the disease may be directly attributed to insanitary conditions, and that it has characteristics which differentiate it purely from malarious fever. The question of a special inquiry into the nature of the fever was under their consideration.

Bowel complaints caused 14,726 deaths, equal to a death-rate of 3·25 per 1,000, against 3·07 in 1887. This increase corresponds with the increase in fevers and cholera. "The same causes (malarial)," Dr. Costello observes, "which generally "produce fever cause dysentery when combined with damp and cold."

Madras.

Registration of births in Madras Presidency during 1888 was not attended with satisfactory results, as the number registered declined from 849,551 or 30·4 per 1,000 in 1887 to 833,345 or 29·9, a decrease of 16,206. The imperfectness of the statistics is further shown in the district birth-rates, which varied between 19·1 in Nilgiris and 40·3 in Salem; and more strikingly in the municipalities, where registration is supposed to be compulsory, whose average rate of only 30·1 per 1,000 was made up of extremes ranging from 9·6 in Tirupati and 50·2 in Erode. Only in four towns was the registered birth-rate above 40 per 1,000, while in 25 towns it was between 30 and 40 per 1,000, and in 26 below 30 per 1,000. On the whole, however, there was an excess of births over deaths in the Presidency of 8·5 per 1,000.

Judged by the number of deaths registered, the public health during 1888 was slightly better than in 1887, though there was a greater mortality from all the chief diseases except fevers, and the rainfall was the lowest registered for some years. The deaths amounted to 597,015 or 21·43 per 1,000 against 604,755 or 21·67 in 1887. The highest district death-rate was 37·8 in Madras City, and the lowest 12·5 in Vizagapatam. Owing to the continued high rate of mortality in Madras district the Local Government has ordered a special inquiry by the Sanitary Commissioner into the conditions of the divisions where the mortality is highest. Infant mortality was again very high, the deaths of children under 5 years of age forming 35·4 per cent. of the total deaths, a rate which Surgeon-Major Laing, the Sanitary Commissioner, considers a proof of local causes of unhealthiness throughout the Presidency. The urban death-rate (27·9 per 1,000) exceeded the rural (20·7) by over 7 per 1,000; and in all districts this was the case. "A chief cause of sickness and death in towns is," Surgeon-Major Laing says, "the insanitary condition of the private houses and "backyards. The houses are badly ventilated, the backyards very often dirty and "drainage of them most defective, and the latrine arrangements unsatisfactory. It

" is, therefore, no wonder that the death-rate of towns is higher as a rule than that of " the small towns and villages, where the people at any rate have comparatively purer " air to breathe."

More than twice as many deaths were registered from cholera than in 1887, the number having risen from 28,359 or 1·01 per 1,000 to 58,677, or 2·10. The disease visited every district except the Nilgiris, and was present in every month of the year, the most fatal month being January, when 18,787 deaths were registered. The ravages of cholera were most severely felt by districts on the east coast, especially Tanjore and Tinnevelly, each of which recorded a mortality of 4·3 per 1,000. Surgeon-Major Laing reports favourably of the measures taken by the district authorities to prevent the spread of the disease, though, he observes, " they can only be looked upon as " palliative, the real remedy being the introduction of cleanliness into every village " at *all* times irrespective of epidemic times or seasons, and not confined only to " periods when sickness is prevailing."

From small-pox the mortality was slightly higher than in 1887, the deaths numbering 21,858 or 0·78 per 1,000 against 21,472 or 0·76. Infants under one year of age furnished 20·7 per cent. of the total deaths from this disease, and children between the ages of 1 and 12 years 38·8 per cent. All the districts were affected, the highest death-rates being returned by Kurnool (2·4 per 1,000), and Ganjam (2·2), in both of which, it is reported, vaccination has always been opposed by the people, and its practice has been carried on under many disadvantages. As a proof of the beneficial effects resulting from vaccination, Surgeon-Major Laing instances the case of Madras Municipality where, since vaccination was made compulsory in May of 1884, the mortality from small-pox has been very small, as the following figures show:—

	Deaths.		Deaths.		Deaths.
1881	1,654	1884	4,064	1887	13
1882	355	1885	26	1888	36
1883	1,957	1886	1		

The year's statistics show a marked decrease in deaths from fevers, the number having fallen from 240,860 or 8·6 per 1,000 in 1887 to 204,561 or 7·34. This decrease was attributed to some extent to the deficient rainfall and dryness of the year; " yet " there can be no doubt," the Sanitary Commissioner remarks, " that there is some " other factor or factors at work besides the moisture which assist in the causation of " fever." In every district except three (Bellary, Malabar, and Nilgiris) the mortality was less than in 1887, the most noticeable case being Vizagapatam, where the deaths fell from 22,011 in 1887 to 12,211, a decrease of 9,800.

Deaths from bowel complaints rose from 26,679 or 0·97 per 1,000 in 1887 to 27,721 or 0·99. The increase was spread over 13 of the 22 districts.

Bombay.

Improvement continued to be made in the registration of vital statistics in the Bombay Presidency. During 1888 a total of 634,693 births was registered, representing a birth-rate of 38·57 per 1,000 of population, against 628,193 or 38·18 in 1887 and a decennial mean of 28·51. The great range of variation, however, as regards both births and deaths in the district ratios, shows that much still remains to be done to ensure accuracy. Of the 24 districts comprised in the Presidency, nine recorded birth-rates ranging from 40·12 to 51·78 per 1,000, 11 from 30·66 to 39·56, and the remaining four from 21·30 to 29·66. Among the urban and rural populations the birth-rates were 28·44 and 40·07 respectively. The loss to the Presidency by deaths amounted to 468,039 or 28·44 per 1,000 against 455,261 or 27·67 in 1887 and a decennial mean of 25·10, the increase being chiefly due to a greater prevalence of cholera and bowel complaints. By districts, Broach recorded the highest death-rate, viz., 42·27, Surat following with 40·68; in seven other districts the mortality was above 30 per 1,000, and in 10 it was above 20 per 1,000. In 5 districts (Broach, Ahmedabad, City of Bombay, Thana, and Surat) the mortality was considerably in excess of the births; in Kaira the respective ratios were about the same, but in the remaining districts the birth-rates were much higher than the death-rates. Infant mortality was, as usual, terribly high, the deaths among children under 5 years of age constituting 42·31 per cent. of the total deaths. Among the urban population the mortality was in the ratio of 31·35 per 1,000, and among the rural population it was 28·04 per 1,000.

Cholera was again very virulent during the year, the deaths having reached 36,500 or 2·22 per 1,000, an increase of 10,789 or 0·66 on the number of 1887. All the districts were affected except Shikarpur and Upper Sind Frontier, and 12·74 per cent.

of the total villages of the Presidency recorded cholera deaths. The disease was specially fatal in Surat, where the death-rate was in the proportion of 7·07 per 1,000. Thana came next with a mortality of 5·88, followed by Broach with 5·75, Ahmedabad with 5·70, and Kolaba with 4·05. Cholera was present in each month of the year. It increased considerably in April and May, and in June it assumed an epidemic form, when the mortality reached 9,801 ; it subsided during the next three months, rose again in October, but declined again in November and December. With regard to the relationship between cholera deaths and meteorological conditions, Dr. Macrury, the Sanitary Commissioner, says : " The data are not yet sufficient to warrant any satis- " factory inference being drawn. An analysis of several years' careful observations, " however, may indicate the connexion of this disease with atmosphere as well as " local insanitary conditions. The fact of epidemic cholera not being generally " regarded as a preventable disease, but with a superstitious dread, as if there were " something supernatural about it, has proved an obstacle to the removal of the well- " known insanitary local conditions which favour its diffusion and development."

There was a slight decrease in small-pox deaths from 3,753 or 0·23 in 1887 to 3,617 or 0·22. All the districts except Kaira returned deaths, though in some the mortality was very slight. According to age 31·16 per cent. of the deaths occurred among infants under 1 year of age, and 49·43 per cent. among children between the ages of 1 and 12 years. The districts which suffered most were Nasik (0·68), Poona (0·56), and Bombay City (0·62). As the Government of India observe, the prevalence of small-pox in Bombay City, where the Compulsory Vaccination Act has been in force 11 years, is to be regretted.

Fevers carried off 304,449 victims, equal to 18·50 per 1,000 of population, against 308,722 or 18·76 in 1887. Broach was again the most fever-stricken district in the Presidency with its death-rate of 31·17 ; in nine other districts the ratios exceeded 20 per 1,000. An examination of the monthly totals of deaths from fever show that the maximum mortality took place in August (28,497 deaths) and the minimum (21,304) in February.

Bowel complaints accounted for 45,462 deaths or 2·76 per 1,000, as compared with 42,634 or 2·59 in 1887. As usual they prevailed most in Belgaum, which headed the districts with a death-rate from this cause of 8·36, Dharwar followed with 6·48, and in the remaining districts the ratios varied between 4·51 and 0·07.

Berar.

Registration of vital statistics in Berar, Dr. Little, the Sanitary Commissioner, says, receives much attention and is fairly well carried out ; and he considers the results fairly represent the birth and death rates of the province. The great disparity in the birth-rates of the several towns, ranging between 20·8 and 56·8 per 1,000, shows, however, that much still remains to be done in the way of improvement. The births registered during 1888 amounted to 108,390 or 41·3 per 1,000 against 106,147 or 40·5 in 1887. According to districts the birth-rates ranged from 38·1 per 1,000 in Wun to 46·2 in Buldana. In the three towns of Amraoti, Akola, and Basim, the results were so unsatisfactory that the Commissioner directed the attention of all Deputy Commissioners to the matter, and requested Dr. Little to suggest special measures to the new district boards and municipal committees for adoption. It is stated that in consequence of the unfavourable remarks in the previous year's report the Amraoti municipality passed a resolution in favour of compulsory registration.

The year 1888 is reported to have been a remarkably healthy one, with an entire absence of disease in epidemic form. There were altogether 64,865 deaths, or at the rate of 24·75 per 1,000 of population, against 118,797 or 45·33 in 1887, which was said at the time to be very unhealthy. By districts the death-rate, like the birth-rate, was highest in Buldana (29·1), and lowest in Wun (19·9). Of the total deaths 29 per cent. occurred among infants, and from birth up to 5 years the percentage of mortality was 49·7.

All the principal diseases except small-pox contributed in a smaller proportion to the mortality of the year, especially cholera, from which there were only 305 deaths as compared with 14,396 or 5·5 per 1,000 in 1887. All the districts were affected except Ellichpur, which was entirely free from the disease. According to a statement given by Dr. Little, the years of highest cholera prevalence in Berar are years of highest average rainfall. " Whatever were the influences, however," he observes, " which kept cholera in abeyance, it certainly was not due to a better sanitary condition " of villages or any improvement in their filthy surroundings."

From small-pox the registered deaths rose from 311 or 0·10 per 1,000 to 817 or 0·31. Of these nearly 33 per cent. were of infants under one year of age, and nearly 62 per

cent. were of children between 1 and 12 years old. Of the six districts in the province, Buldana suffered most, contributing 363 of the fatal cases, Amraoti followed with 163, and Basim with 148, while in Ellichpur there were only 7 deaths.

Fevers accounted for fewer deaths than in any year since 1873; and the number declined from 48,114 or 18·36 per 1,000 in 1887 to 29,979 or 11·44 in 1888. The district rates varied from 10·1 in Basim to 22·4 in Wun, and it is remarkable, the Government of India notice, that the districts maintained almost the same positions in respect of mortality as they did in the previous year. Dr. Little attributed the diminution in fever mortality to the low rainfall, which was 19 inches less than in 1887, "for the "characteristic elements of weather," he says, "which are most important in affecting "the health conditions of the individual are a damp soil, together with alterations in "temperature, causing increased evaporation with day and night fluctuations of heat "and cold and consequent chills."

The deaths registered under bowel complaints amounted to 9,987 or 3·82 per 1,000 against 21,530 or 8·21 in 1887. Dr. Little, however, points out that classification of death causes is very inaccurate, and especially so under bowel complaints.

IV.—JAILS.

Sickness and mortality in 1888.

Estimated by the admission and daily sick rates, the health of the jail population of India during 1888 was not so good as in the previous year. Among a daily average number of prisoners of all classes of 79,042, the admissions into hospital were in the proportion of 1,004 per 1,000 against 947 in 1887, and the daily average sick 33 per 1,000 or 1 more. According to provinces the ratio of admissions was lower in Bengal and the Central Provinces as compared with 1887, and higher in every other province, especially in the Punjab and Lower Burma. But though the general health statistics were not so good as in 1887, the ratio of deaths was proportionately smaller than in that year, viz., 33·10 per 1,000 against 35·61. The number of deaths from cholera was 368, equal to 4·65 per 1,000 of average strength, against 325, or 4·58. From fevers and bowel complaints the mortality was slightly less than in 1887. The death rates from all causes varied from 12·78 in Berar to 44·71 in Bengal, and 44·88 in Lower Burma. The Punjab, Central Provinces, Lower Burma, Assam, Coorg, and Berar showed an improvement in mortality as compared with the previous year, while there was an increase in Bombay, North-Western Provinces and Oudh, Madras and Bengal, especially the latter, which was mainly due to cholera, the number of deaths from this disease having increased from 21 to 132.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1888, as compared with 1887:—

Provinces.	1888. Ratio per 1,000 of Average Strength.			1887. Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,383	46	44·71	1,421	45	32·73
North-Western Provinces and Oudh	786	30	28·32	723	26	27·64
Punjab*	1,307	28	30·70	1,159	26	44·52
Lower Burma	1,094	46	44·88	944	49	58·70
Central Provinces	893	28	41·23	972	30	65·77
Assam	1,757	56	26·99	1,676	53	28·03
Coorg	1,713	52	41·53	1,620	52	63·44
Madras	680	24	25·50	614	22	23·03
Bombay	561	20	22·94	548	23	19·69
Berar	761	16	12·78	720	15	26·70
India	1,004	33	33·10	947	32	35·61

* Excluding figures for subsidiary jails.

Bengal.

The sanitary history of the Bengal jails for 1888 compares very unfavourably with that of the previous year. The ratio of daily average sick rose from 44 to 46, and of deaths from 32·72 to 44·71. It is noticed, however, that notwithstanding this great rise in mortality, the death-rate was still very much below the average of the last quarter of a century (58·7 per 1,000), and that within that period only three years showed a lower mortality than 45 per 1,000. The most marked feature in the year's statistics was the increased mortality from cholera, the deaths having risen from 21 or 1·67 per 1,000 to 132 or 9·61. The death-rate from dysentery and diarrhœa also rose from 12·6 to 15·22. Of the 44 jails in the province, 30 were exempt from cholera, and in only six were there more than two cases. The jails of Rajshahye, Rungpore, and Alipore were the chief sufferers, recording two-thirds (88) of the total cholera deaths. In the districts in which the largest number of fatal cases occurred, the epidemic, it is reported, had obtained a firm hold on the outside population before any of the prisoners were affected. Measures were being taken to provide camping grounds for all central and district jails.

Among convicts there were 571 deaths or 46·1 per 1,000 against 363 or 33·2 in 1887. Of those who died in jail only 28·39 per cent. were in good health on admission, 40·14 per cent. were in indifferent health, and 31·47 per cent. were in bad health.

The following statement gives the jails which recorded death-rates among convicts of over 50 per 1,000 :—

Jails.	Death-rate per 1,000 of Average Strength.		Jails.	Death-rate per 1,000 of Average Strength.	
	1888.	1887.		1888.	1887.
Lohardugga - - -	191·3	98·8	Mozufferpore - - -	77·8	17·7
Maldah - - - -	181·9	84·8	Bogra - - - -	70·9	53·0
Rungpore - - -	173·6	104·3	Beerbhoom - - -	64·8	40·0
Singhboom - - -	169·8	40·7	Dinagepore - - -	63·8	89·9
Rajshahye - - -	136·5	44·8	Mymensingh - - -	55·1	36·9
Gya - - - -	114·7	36·5	Khoolna - - - -	51·8	253·6
Purneah - - -	104·6	62·4	Darjeeling - - -	51·4	36·7
Pubna - - - -	90·0	14·5	Patna - - - -	50·8	39·9

The high death-rate of Lohardugga jail was accounted for partly by cholera, as in the two previous years there was an absence of this disease in the jail, and partly by the bad state of health of prisoners admitted during the year; "fully half of the prisoners " admitted were either in bad or indifferent health, many suffering from ulceration of " the gums, and well-marked malarial cachexia." In fact, in nearly all the above cases the low standard of health of prisoners admitted played a prominent part in the mortuary statistics. "It is simply impossible for anybody," the Officiating Inspector of Bengal Jails says, "however great his opportunities may have been in other " provinces, to realise without personal experience the wretched and diseased state " of health of the prisoners annually admitted into the Bengal jails. This well-" recognised low standard of public health and climatic influences are undoubtedly the " main causes of the high death-rate in these jails, and of course such conditions are " intensified from time to time, and in different localities, by outbreaks of epidemic " disease, and the presence of scarcity. . . . . Expensive buildings, good food, " improved water-supply, suitable labour, and the best medical treatment are furnished. " In fact, nothing is withheld that is likely to improve health and prolong life. The " number of prisoners discharged from jail that have increased in weight and " improved in health is a satisfactory proof of what is being achieved. In addition to " official visitors, the condition of the prisoners is now carefully watched by non-" official European and Native gentlemen who have been selected by Government to " visit jails. My own belief, founded on over 20 years' experience as a Superintendent " of Bengal Jails, is that many prisoners who enter jail are kept alive who would " certainly have died had they not been imprisoned. This is a view of the question " which is often overlooked in criticising jail administration."

North-Western Provinces and Oudh.

The general health of the jail population of the North-Western Provinces and Oudh was less satisfactory in 1888 than in the previous year. The ratio per 1,000 of admissions to hospital rose from 723 to 786, the daily sick rate from 26 to 30 per 1,000, and the mortality from 27·64 to 28·32. Fevers were the chief causes of the increased sickness, and respiratory diseases and dysentery and diarrhœa of deaths, more than a half of the total 629 deaths having occurred from them. Another cause for the increased mortality was the larger number of prisoners who entered the jails in a reduced condition on account of scarcity caused by high prices of food. Cholera was fatal in 25 cases against 52 in 1887, and of these the Benares Central jail alone contributed 21. Of the 51 jails in the provinces the average mortality was exceeded in 27, of which 16 recorded death-rates ranging from 40·90 per 1,000 to 100·49; but several of them are small jails, and three or four deaths gave very high ratios, as in the case of Etawah, where five deaths yielded a death-rate of 76·88 per 1,000. The most unhealthy jail was Banda, with an average death-rate for the six years ending 1888 of 77·40. Regarding this jail, the Inspector-General reports: "The buildings " are not well designed; they are crowded within closely circumscribing walls which " obstruct ventilation and dryage of the subsoil of the yards in wet weather, and " radiate at night heat acquired during the day; surface drainage is imperfect;

" conservancy was defective; water is bad." It is stated that measures have been taken to ascertain, among other matters, if a better water-supply cannot be provided. The question, however, whether in view of the facts the jail in its present site should be maintained was engaging the attention of the Local Government. In the case of two or three other jails, bad sites were reported as a disadvantage to the health of prisoners.

Among convicts the death-rate was in the proportion of 28·65 against 27·72 per 1,000 in 1887.

Punjab.

The health statistics of the Punjab jails show that there was more sickness among the prisoners in 1888 than in the previous year; but this the Inspector-General attributed to the greater care taken in bringing under early medical treatment prisoners suffering from serious diseases. On the other hand, there was a considerable fall in the death-rate, viz., from 44·52 to 30·70 per 1,000 of average strength, a ratio almost the same as in the case of the free population, among whom the death-rate for 1888 was 29·89 per 1,000. There was a decrease in the mortality from all the more ordinary diseases, which was considered satisfactory as showing an improvement in the general health of the prisoners. Cholera was fatal in 63 cases (equal to 5·26 per 1,000 of average convict population), or 3 less than in 1887, and these were confined to three jails, Lahore Central Jail recording 30 deaths, Rawalpindi 19, and Chenawan 14. It is noticed that before the outbreak of cholera in these jails their sanitary condition was not satisfactory, especially that of Lahore and Rawalpindi, and that the prisoners in both these jails, too, were in a state of health below par. In four jails, all of them small, there were no deaths, and in 11 the mortality did not exceed 14·08 per 1,000. In 10 jails the mortality was very high, ranging from 57·68 in Lahore Central Jail to 36·04 in Dharmsala, these high death-rates being attributed in a great measure to overcrowding. But although the mortality was high in Lahore jail, there was a satisfactory decrease as compared with the previous year, which was 126·05 per 1,000. This reduction in the opinion of the Inspector-General was due chiefly to three causes: " First, the year was more healthy than the previous one, as " is proved by the low death-rate of the free population; secondly, there was left in " jail a smaller proportion of old, infirm, and sickly prisoners, so many having died " in 1887; and, thirdly, increased attention has been paid to all matters affecting the " health of the jail, especially to the management and treatment of the convalescent " gang."

Among convicts the death-rate was 31·08 per 1,000 against 46·50 in 1887. According to age, the mortality among old convicts was remarkably low compared with that of 1887, the ratio per 1,000 of average strength of those of 40 years old and upwards having decreased from 80 to 43. The statistics showing the mortality of convicts according to length of residence in jail continued to show that the periods of greatest mortality were from three to seven years (50·08), and over seven years (60·91).

Burma.

The health of the jail population of Lower Burma was much better in 1888 than in 1887. The number of admissions to hospital was greater, being in the ratio of 1,094 per 1,000 against 944, but the daily average sick-rate fell from 49·24 per 1,000 to 46·25, and the death-rate from 58·70 to 44·88. Of the total 393 deaths, 18 were from fevers, 130 from bowel complaints, and 105 from cholera, against 21, 134, and 109 respectively in the previous year out of a total of 453. The increase in the number of admissions was attributed to increased attention on the part of Superintendents to the health of prisoners under their charge, many prisoners being admitted to hospital suffering from trifling ailments who formerly would not have been placed on the sick list. Out of the total 393 deaths, 369 were of convicts, the death-rate being in the proportion of 44·17 per 1,000 against 58·86 in 1887. But although the health statistics of the year were more satisfactory than those of 1887, there was still much room for improvement in some of the jails. Toungoo Jail recorded the highest death-rate, viz., 150·10 against 35·48 in 1887, the total number of deaths being 77, of which 36 were due to cholera, and 24 to bowel complaints. In the previous year this jail was free from cholera, and there were only 4 deaths from bowel complaints. The high mortality in the year under notice was attributed to some extent to defective accommodation for the prisoners. An inquiry into the condition of this jail was to be made by the Inspector-General. The Moulmein and Bassein jails also suffered severely from cholera during the year, the former recording 29 deaths from the disease out of a total mortality of 77, and the latter 22 out of 55. In consequence of

the high mortality in the Moulmein jail (80·18 per 1,000) and the general bad health of the prisoners, the closure of the jail was under consideration; but instead of taking this step it was decided to limit its population to 900, a little more than one-half the number which it is capable of accommodating. The health of the prisoners in the Rangoon jail was more satisfactory than in 1887. The ratio of daily average sick on the native side of the jail fell from 71·08 per 1,000 to 58·44, and the death-rate from 49·00 to 30·87.

In the jails of Upper Burma, sickness and mortality was much higher than in those of Lower Burma, the daily average sick-rate having been 71·9, and the death-rate 88·89 per 1,000. This was attributed partly to the state of health of many prisoners at the time of admission, and partly to the disadvantages incident to the construction and management of jails in a new country, where the sanitary conditions are not yet well known. Several of the jails were visited by epidemics of cholera and beri-beri, which caused 70 (59 and 11 respectively) out of the total 136 deaths. In the Mandalay jail, which is the only one in which large numbers of prisoners were confined, the sick-rate was 75·47 and the death-rate 59·65. Out of 51 deaths in this jail 42 were of prisoners who had been less than six months in jail or who were under trial.

Central Provinces.

The statistics of the jails in the Central Provinces, taken as a whole, also compare favourably with those of the previous year. While the admission and daily sick-rates fell from 972 and 30 per 1,000 respectively in 1887 to 893 and 28, the death-rate, 41·23, was the lowest recorded except that of 1881, and 24·54 per 1,000 below that of 1887. In a great measure this improvement was due to the freedom of the jails from cholera or any other epidemic. Of the total 171 deaths, all but 3 occurred among convicts, the ratio being in the proportion of 42·61 per 1,000 of average strength against 70·23 in 1887. The decrease in mortality was spread over most of the jails, and in some it was very marked, which was attributed mainly to the stoppage, under the orders of the Chief Commissioner, of the transfer of weakly and infirm prisoners to the Central Jails, "a change in procedure which," it is stated, "enforced rigorously as it "was in the case of Jubbulpore and Raipur, affects the vital statistics of all the district "jails affiliated to those institutions." Of the 19 jails in the province seven had no deaths, in four the mortality was under 30 per 1,000, in four it ranged from 37·0 to 46·3, and of the remaining four, Nagpur recorded 57·4, Nimar 86·7, Sambalpur 108·5, and Hoshangabad 109·1. "There can be no doubt," the Inspector-General states, "that since Dr. Lethbridge's visit to these provinces the causes of much of the "mortality which occurred have been made plain, and that Superintendents have "learned how the usual forms of sickness can best be combated."

Assam.

Among the Assam prisoners there was slightly more sickness than in 1887, the ratio of admissions to hospital and the daily sick-rate having risen from 1,676 and 53 per 1,000 respectively to 1,757 and 56. On the other hand the ratio of deaths fell from 28·03 per 1,000 to 26·99. This is the more satisfactory as the year was one of some cholera prevalence, the deaths from that disease having increased from 1 in 1887 to 6 in the year under notice. In the case of the convict population, however, the death-rate showed a small increase (from 24·57 to 26·43) which was entirely due to cholera, the death-rate from other causes having fallen from 23·91 to 22·47 per 1,000. The results of extra-mural labour on the health of the prisoners were again satisfactory. Among the convicts so employed in Public Works Jails, there was not a single fatal case from any disease, while the deaths among under-trial prisoners fell from 9 in 1887 to 4. In several jails there was considerable overcrowding, especially in Dhubri jail, in consequence of which the Chief Commissioner has sanctioned its enlargement.

Madras.

The health of the prisoners in the Madras Presidency during 1888 was not so satisfactory as in the previous year. The admissions to hospital were in the ratio of 680 per 1,000 of average strength against 614 in 1887, the daily sick 24 or 2 per 1,000 greater, and the mortality 25·50 against 23·03. The chief causes of death were dysentery, diarrhœa, anæmia, general debility and consumption. Cholera accounted for 12 deaths, the largest mortality since 1883, 5 of which occurred in the Penitentiary, 5 in Trichinopoly, and 2 among under-trials in subsidiary jails. Of the 26 district jails, Parvatipur recorded the highest death-rate (115·80), the chief cause being the bad state of health in which prisoners were admitted, especially those from Jeypore above the ghauts. For a number of years this jail has been notorious for its high death-rate, and as during the year under notice 6 of the total 19 deaths were from

bowel complaints, and 5 were from anæmia, the Government directed that a special enquiry into the cause of its unhealthiness should be instituted by the Inspector-General. Cannanore Central jail came next on the list in point of mortality (72·23). The unhealthiness of this jail was partly attributed to its being used as a depôt for prisoners sentenced to transportation, but declared unfit to be transported, consequently a considerable number of aged convicts had accumulated. Still, as the death-rate among convicts under 40 was high, viz., 49·77, the Government considered its causes needed further investigation. The only other jails in which the mortality was high were Mangalore (63·59), Coimbatore (53·06), Berhampore (52·29), and Trichinopoly (40·08). In five jails, viz., Nellore, Cuddapah, Cochin, European Prison, and Debtor's Prison there were no deaths.

Of the total 202 deaths 176 were of convicts alone, being in the proportion of 25·57 per 1,000 of average strength. There was very little variation from the average in point of mortality at the several age periods, though in each it was higher than in the preceding year; while according to length of time passed in jail, the mortality of those who had undergone from two to seven years' imprisonment formed 5 per cent. of the total against 2 per cent. in 1887.

Bombay.

Though not quite so satisfactory as in 1887, the health of the prison population of Bombay Presidency in 1888 was not on the whole bad. With an increase in the daily average strength from 6,092 to 6,840, the admissions into hospital were in the ratio of 561 per 1,000 against 548, the daily sick-rate 20 per 1,000 against 23, and the death-rate 22·94 against 19·69. From all the principal diseases the mortality was greater than in 1887 especially from cholera, there having been 24 deaths as compared with 10. The only jail which showed an abnormally high death-rate was Nasik (115·4 per 1,000 against 50·0 in 1887), due however to the fact that among a small number of prisoners (average strength 52) there were 6 deaths, 4 being from cholera. This disease was very prevalent in the town throughout the year, and the jail from its position and surroundings is in such a case almost bound to suffer from it. In several other jails the death-rates were comparatively high, which would appear to have been due to exceptional causes, though in no other case did the mortality exceed 43 per 1,000. "It cannot be expected," the Government observe, "that jails should wholly escape the "effects of an epidemic of cholera, or that extra-mural convicts exposed to severe "climatic surroundings should not in some degree suffer."

Among the convict class the death-rate was 22·9 per 1,000 against 20·8 in 1887. Of the total 137 deaths among them, 67 per cent. had not been more than 12 months in jail.

Berar.

In the jails of Berar there was rather more sickness but less mortality in 1888 than in the previous year. The ratio of admissions to hospital was 761 per 1,000 of average strength, the daily sick-rate was 16 per 1,000 or 1 more, while the death-rate was particularly low, being only 12·78 against 26·79 in 1887. There were no deaths from cholera, and no single disease caused more than one death, which is considered satisfactory as indicating the existence of no serious defects in the sanitary arrangements of the jails. No one period of prison life was specially fatal to convicts, the 13 deaths which occurred during the year having been very evenly distributed. The 13 deaths were confined to the two jails Amraoti and Akola, the former contributing 5 or 13·41 per 1,000 of average strength, and the latter 8 or 20·10 per 1,000. All the jails were inspected by the Inspector-General at least once, and also by the Commissioner with the exception of that at Yeotmal. "So far as I have been able to judge," the Commissioner states, "the several Superintendents bestow considerable care and attention "upon the duties entrusted to them, and I think that the year's record shows that the "Inspector-General's administration of the jails in the Hyderabad Districts is, on the "whole, very satisfactory."

V.—VACCINATION.

General results.

In the several provinces of India, excepting Mysore, the statistics of which were not available, 5,640,967 persons were successfully vaccinated during 1888 against 5,202,595 in 1887, showing an increase of 438,372, which was shared in by all the provinces except Coorg. According to age, 2,473,599 of the successful cases were of infants under one year of age, and 2,729,374 were of children between the ages of one and six years. The proportion of population protected was greater in all provinces but Bengal and Coorg, the ratio per 1,000 ranging between 40·84 in the Punjab and 15·14 in the North-Western Provinces and Oudh. As regards the vaccination of infants, the best results were again obtained in Berar, where 79·4 per cent. of the births (estimated at 40 per 1,000 of population) were protected against small-pox. The next highest percentages were 59·4 in the Punjab, 58·0 in Bombay, and 46·8 in the Central Provinces, the remainder varying between 17·9 in the North-Western Provinces and Oudh, and 10·0 in Lower Burma and 8·5 in Coorg.

Bengal.

The total number of vaccinations performed in Bengal during 1888–89 was 1,846,169 against 1,718,655 in 1887–88, showing an increase of 127,514 in the year under notice. Of these, 1,838,215 were primary cases, with a percentage of success of 99·27. The number of infants successfully vaccinated was 271,216, equal to 11·5 per cent. of births estimated at 40 per 1,000 of population, and of children between one and six years old, 1,296,990. As usual, the work of the year was generally started throughout the province with bovine lymph, supplemented by supplies from England and from the hills. Calf lymph appears to be much appreciated by the people, and was said to be daily gaining ground in the public estimation. "Speaking generally," the Sanitary Commissioner says, "the present attitude of the people towards vaccination "is one of passive acceptance of the prophylactic. But in nearly every village there "are families who refuse vaccination openly, or who covertly hide away their children "from the vaccinators. What the villagers mostly object to is to allow their children "to be used as vaccinifers, as this usually entails their carrying their children to the "adjacent village, and other discomforts." Continued progress was made in the introduction of vaccination. It was introduced for the first time in the Chittagong district, and it was extended to the four remaining thanas of Gya and to six thanas of Balasore; operations were also performed for the first time in parts of Sarun and Chumparun to suppress local outbreaks of small-pox.

North-Western Provinces and Oudh.

Vaccination in the North-Western Provinces and Oudh makes but slow progress. During 1887–88 there were 764,190 operations performed against 751,875 in the previous year; and of these, 743,140 were primary cases, with a percentage of success of 92·74. Of children under one year of age 316,114 were protected against small-pox (equal to about a fourth of the registered births), and of those between one and five years, 306,325 were vaccinated. In successful primary cases there was an increase of 6,623 on the number of the previous year. The increase, however, was confined to the second or Oudh circle and the third circle, the latter comprising the Allahabad, Benares, and Jhansi divisions. But although the Oudh circle showed an increase of 19 per cent., the condition of vaccination there is still far from satisfactory, for while the average number of persons vaccinated throughout the entire provinces was 15 per 1,000, in no district of Oudh did the ratio reach 10 per 1,000. The Local Government have issued a circular to all district officers in that province, calling upon them to interest themselves more closely in the matter of vaccination. "Widespread indifference," Dr. Thomson (of the Oudh circle) states, "and actual hostility to the operation exist, and the prejudice is far too deep-rooted "to be removed by such measures as the circulation of pamphlets setting forth the "benefits of vaccination, or the occasional solicitation of assistance from Native "gentlemen. What is required is the constant steady advocacy of the operation "until all throughout the district recognise how deeply the district officials are "interested in the matter." In the first circle the decrease was confined to the Agra division, and was mainly owing to much time having been spent in inquiring into cases of falsification of register, a practice which is stated to be still not uncommon in the Vaccination Department, and which the Government of India trust the Local Government will do their best to put a stop to.

Punjab.

The Punjab vaccination returns show a considerable improvement on those of 1887–88. The total number of persons vaccinated during 1888–89 was 942,295, an increase of 261,553 on the previous year. Of these 668,458 were primary cases, with a percentage of success of 95·13, indentically the same ratio as in 1887–88. The increase in the number of vaccinations was, however, confined chiefly to Kangra district, where 240,784 persons were reported to have been vaccinated, equal to about a third of its population. Previous to the year under notice, vaccination had been in rather an unsatisfactory state in Kangra, and the result attained appears to have been due chiefly to the influence of Pandit Balkishen, late Superintendent of Vaccination, who was appointed by the Deputy Commissioner to supervise the work, and who is reported to have persuaded almost every person he met to submit to the operation. Of the total successful primary cases 447,429 were children under one year of age, and 155,399 were children between the ages of one and six years. One of the most satisfactory features of the year's work was the rapid extension of the use of animal lymph, 104,172 vaccinations having been performed with it: very nearly a ninth of the total number vaccinated. There appears to have been a great want of efficient supervision of the work of vaccinators, for the Sanitary Commissioner states that vaccinators, in order to swell their returns, enter as successful cases those which are really spurious. Such cases, he observes, are often followed by small-pox, which fully accounts for the people losing faith in vaccination. The Government of India have directed the Lieutenant Governor's special attention to this matter, in the hope that arrangements will be made for more efficient supervision.

Lower Burma.

Considerable progress was made during the year in the extension of vaccination in Lower Burma. The number of persons vaccinated was 97,101 against 76,618 in 1887. The increase was most marked in the districts of Hanthawaddy (including Rangoon town) and Toungoo, the operations in the former having increased from 19,004 to 30,708. The work of the vaccination officers in Rangoon and Hanthawaddy is reported to have been excellent, and the comparative immunity of the inhabitants of Rangoon from small-pox (only seven deaths among a population of 134,176) the Health Officer attributed to their very general protection by vaccination, "which the "local cultivation of calf lymph has alone rendered possible." The number of persons primarily vaccinated in the province was 77,447, with a percentage of success of 85·6. Of the total vaccinations 15,036 were of children under 1 year, and 39,917 were between 1 and 6 years of age.

Central Provinces.

The total number of vaccinations performed in the Central Provinces during 1888, including dispensary work, amounted to 449,727, of which 422,183 were primary cases with a percentage of success of 95·84. In order, however, to compare the year's work with that of 1887 the returns of the two states Bamra and Sonpur must be omitted, as they were not received in time for incorporation in the report for 1887. With this omission the operations numbered 444,373 in 1888 against 427,290 in 1887. Satisfactory progress was made in the vaccination of children. Of the successful primary cases, omitting the states above mentioned, 205,338 were children under 1 year of age, which is an increase of 23,008 on the figures of 1887. As an instance of the influence which vaccination exercises on small-pox, the Superintendent-General of Vaccination notices that in seven districts in which the proportion of persons vaccinated almost equalled or exceeded the provincial birth-rate (41·52) the ratio of deaths from small-pox per 1,000 of population was 0·33, whilst in the 11 districts in which the ratio of persons vaccinated fell below the provincial birth-rate, the ratio of deaths from small-pox was 2·32 per 1,000, or seven times greater. Buffalo lymph was tried in three districts and proved successful in the vaccination of children.

Assam.

The total number of persons vaccinated in Assam during 1888 was 134,138, being an increase of 1,789 on the operations of the previous year. The increase was confined to four districts. Sylhet and Goalpara districts showed the greatest progress, while there was a considerable decrease in Nowgong, Lakhimpur, Naga Hills, and Darrang. Of the total vaccinations 133,472 were primary cases with a percentage of success of 91½. Exclusive of tea gardens, 21,771 children under 1 year of age were vaccinated, and 72,313 were between 1 and 6 years old. The total successful cases were in the proportion of 25·38 per 1,000 of population. Inoculation continued to be practised very largely in the province, especially in Goalpara district, where out of 14,167 dispensary patients examined 9,017 were found to have been inoculated. Dr. Costello recommended that inoculation should be made penal in Assam as it has been the cause of serious epidemics of small-pox and loss of life.

Madras. Fair progress was made in vaccination in Madras Presidency during 1888–89. The number of operations increased from 738,480 in the previous year to 809,417, of which 796,362 were primary cases, with a percentage of success of 95·4 against 95·0 in 1887–88. Nearly three-fourths of the persons vaccinated were children under 6 years of age. On the whole the work of district vaccinators showed an improvement over that of the previous year, but in 6 districts the out-turn was less than in 1887–88. "As usual," the Acting Inspector of Vaccination says, "the absence of vaccinators generally "appears to have been the chief cause; also prevalence of cholera and fevers in Malabar, "absence of small-pox, opposition to vaccination, and bad work on the part of some "vaccinators." The district of Coimbatore exhibited the best results, and Nilgiris the worst. Vaccination was compulsory in 21 municipalities, in 6 of which it was introduced during the year under notice. Animal vaccination was practised in 10 districts. In all 42,445 operations were performed with animal lymph, of which 94 per cent. were successful, against a percentage of 86 in the previous year. The desirability of superseding human by animal vaccine has been impressed in the local and municipal departments on all local boards and municipalities.

Bombay. Satisfactory progress continued to be made in vaccination work in Bombay Presidency. During 1888–89 the total number of persons vaccinated was 951,094 or 21,549 more than in the previous year. Primary cases amounted to 896,394, the percentage of success being 95·02 against 879,755 and 95·40 respectively in 1887–88. Of the successful primary vaccinations 593,818 were children under 1 year old, and 242,130 were between the ages of 1 and 6 years. Human lymph was used everywhere except at Bombay, Poona, Rajkot, Bandra, Kurla, Igatpuri, Dharwar, and Belgaum, where animal lymph was either wholly or partially used. "Considerable difficulty is "experienced," Dr. Macrury, the Sanitary Commissioner, states, "in keeping up arm-"to-arm vaccination in some towns on account of the refusal of parents to allow "vaccinators to take lymph from their children; and as animal vaccination entails "expenditure beyond the means of most municipalities, it would be advisable to make "it obligatory to give lymph when required. This would be a preparatory step "to making vaccination compulsory, which can only be a matter of time." The Government of India, however, did not approve of this recommendation.

Berar. The vaccination returns of Berar show that 105,602 persons were vaccinated during 1888 against 97,158 in 1887. The increase of 8,444 was attributed partly to the greater attention which vaccination received in all districts except Basim. The primary cases numbered 101,225, of which 96·3 per cent. were successful. Of the successful primary cases 77,096 were infants under 1 year of age, and 18,407 were children between the ages of 1 and 5. Estimating the births at 40 per 1,000 of the population, the proportion of children successfully vaccinated was 79·4 per cent., and the proportion of population protected was 36·6 per 1,000 against 35·2 in 1887.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1887 and 1888, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1887	243	24,474	1,055,465	1,079,939
	1888	250	25,751	1,106,700	1,132,451
Calcutta and Howrah	1887	7	22,785	241,064	263,849
	1888	7	22,612	231,094	253,706
North-Western Provinces and Oudh	1887	259*	49,376	2,104,850	2,154,226
	1888	262*	51,968	2,375,765	2,427,733
Punjab	1887	202	43,770	1,989,123	2,032,893
	1888	203	43,667	2,087,034	2,130,701
Lower Burma	1887	35	15,079	197,059	212,138
	1888	35	15,600	213,059	228,657
Central Provinces	1887	102	7,308	801,756	809,064
	1888	104	7,598	842,367	849,965
Assam	1887	59	3,593	185,994	189,587
	1888	62	3,466	221,005	224,471
Coorg	1887	2	423	14,879	15,302
	1888	3	396	10,093	10,489
Madras	1887	344	42,148	2,128,139	2,170,287
	1888	375	43,447	2,264,650	2,308,097
Bombay	1887	230	37,123	1,657,710	1,694,833
	1888	237	37,248	1,677,928	1,715,176
Berar	1887	43	2,360	246,150	248,510
	1888	43	2,383	254,416	256,799
Total	1887	1,526	248,439	10,622,189	10,870,628
	1888	1,581	254,136	11,284,109	11,538,245

* Statistics were furnished for only 234 in 1887 and for 238 in 1888.

Bengal. The establishment in Bengal of nine dispensaries and the abolition of two during 1888 brought the total number of these institutions to 250. One of the new dispensaries, however, having been opened late in the year, no returns of the work done were furnished, consequently the statistics deal with 249 institutions. The total number of patients was 1,132,451, of whom 1,106,700 were out-patients and 25,751 were in-patients, against 1,055,465 and 24,474 respectively in 1887. The increase was attributed partly to the growing popularity of the dispensaries, and partly to the prevalence of greater sickness. Among the in-patients the deaths were in the ratio of 127·7 per 1,000 as compared with 127·1 in 1887. Of the diseases from which the patients sought relief, malarial fevers came first, followed by skin diseases, goitre, ulcers, worms, ear diseases, rheumatic affections, eye diseases, &c., all of which showed an increase; on the other hand cholera cases declined from 6,300 in 1887 to 4,839, dysentery from 27,936 to 25,795, diarrhœa from 27,003 to 26,268, and spleen diseases from 44,420 to 40,731. Another proof of the increasing popularity of the Bengal dispensaries is the steady increase in surgical work, the number of major operations having risen from 4,139 in 1887 to 4,622, and those of a minor order from 54,189 to 56,334.

Notwithstanding that the death-rate in Calcutta and the Suburbs in 1888 was higher than in the previous year, the attendance at the hospitals, exclusive of the voluntary lock hospitals, was less by 7,471, as shown in the following table :—

Medical Institutions.	1888.				1887.			
	Total Treated.			Died per 1,000 of treated.	Total Treated.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
Medical College Hospital	6,194	45,800	51,994	102·1*	5,953	48,518	54,471	105·1*
General Hospital	2,968	—	2,968	37·39	2,966	—	2,966	41·13
Mayo Institutions	2,833	174,769	177,602	97·42	2,736	179,249	181,985	85·5
Campbell Hospital	6,497	—	6,497	215·94	6,432	—	6,432	210·35
Municipal Police Hospital	2,735	—	2,735	10·96	2,738	—	2,738	8·4
Total Calcutta Hospitals	21,227	220,569	241,796	115·82*	20,825	227,767	248,592	113·39*
Howrah General Hospital	1,385	10,525	11,910	247·65	1,502	11,083	12,585	183·7
Grand Total	22,612	231,094	253,706	124·05*	22,327	238,850	261,177	118·21*

* Reckoned on cases treated exclusive of cases treated in the ophthalmic ward of the Medical College Hospital.

It is explained, however, that the figures for Calcutta were vitiated by the fact that the returns of Chadney Hospital (attached to the Mayo Hospital), where nearly one-third of all the out-patients of Calcutta are supposed to be treated, were found to be inaccurate. The Resident Medical Officer has since been changed, and it is hoped the Superintendent will succeed in future in more effectually checking the returns submitted. There was a diminution in the numbers of Hindu and Mahomedan women and children, which it was thought was probably due to the successful working of the out-door department of the Dufferin Hospital. Owing to increased mortality from cholera (521 deaths against 341 in 1877) the death-rate among the in-patients rose from 118·21 per 1,000 to 124·05. Excluding cholera, the death-rate was 104 per 1,000, or 1 less than in the previous year. Of the particular diseases among in-door patients, small-pox cases continued to be very small, there having been only 23 cases in 1888; cholera cases rose from 612 to 905. On the other hand there were fewer cases of dysentery, malarial fevers, and venereal diseases. The year's returns show a satisfactory increase in the number of important surgical operations, 1,719 having been performed against 1,488 in 1887. Minor operations also increased from 16,487 to 20,264.

North-Western Provinces and Oudh.

There were 262 civil dispensaries and hospitals open in the North-Western Provinces at the close of 1888, or three more than in 1887. Statistics were furnished for only 238, and these institutions showed an unprecedented expansion of work in all directions. The total number of patients treated was 2,427,733 against 2,154,226 in 1887, being an increase of 273,507 or 12·6 per cent., which is stated to be the greatest increment on record. In-door patients rose from 49,376 to 51,968, and among these the death-rate was 55·8 per 1,000 against 62·9 in 1887. The increase in the total number treated, both in-door and out-door patients, was shared in by 44 out of 49 districts in the province. The number of surgical operations rose from 110,717 to 124,267, an increase of over 12 per cent. Of these 16,492 were major operations, showing an increase of 7 per cent. on the number of 1887. It is also noticed that there was a most satisfactory increase in the contributions made both by District Boards and by the private liberality of natives. "All these facts," the Local Government observe, "indicate a steady development in the appreciation by the masses of the people of "European medicine and surgery, which it may in the near future be beyond the "resources of Government to cope with, unless they are assisted by a corresponding "development of private contributions or private practice. The very great rise in the "numbers attending the dispensaries at Lucknow, Gorakhpur, Jhansi, and Muzaffar-"nagar is much to the credit of the officers in charge, and is a proof that exceptional "professional skill commands a wide and ready recognition."

As regards the diseases under treatment, fever cases showed an increase of 33 per cent. over the previous year, and leprosy about 20 per cent.; on the other hand there was a marked decrease in cases of cholera and bowel complaints.

Punjab.

The number of dispensaries in existence in the Punjab during 1888 was 203, being an increase of one on the previous year. At these there were 43,667 in-patients under treatment, or 103 less than in 1887, and 2,087,034 out-patients, which is a greater number by 5 per cent. than that of the previous year. Notwithstanding the decrease in in-patients, the death-rate was slightly higher, reaching 56·3 per 1,000 against 55·3

in 1887. The diseases under treatment were of the usual type; malarial fevers, ulcers, skin diseases, and diseases of the digestive and respiratory organs and of the eye accounted for the great majority of the cases; cholera cases numbered 3,033 against 5,042 in 1887. In major operations there was a slight falling off, from 10,894 to 10,263, but minor operations rose from 146,242 to 152,520. During the year the Lady Aitchison Hospital for women was open at Lahore, and as many as 437 Eurasians were under treatment. The question of providing a hospital for Europeans at this place was under the consideration of the Government. The Inspector-General of Hospitals again brought to notice the urgent need of a suitable institution at Delhi, the present buildings there being either unsuitable for hospital purposes or insufficient to meet the increasing demands of the neighbourhood.

Lower Burma.

There were 35 dispensaries open in Lower Burma during 1888, the same number as in the previous year, and the total number of patients under treatment was 228,657, of whom 15,600 were in-door patients. Compared with the previous year there was an increase of 16,519 patients, 521 being in-patients. One satisfactory feature in the year's work was the increase in the number of Burmese patients by 12,000, the natives hitherto having shown a marked prejudice to European treatment. There is still much room for improvement in this direction, for while, according to the last census, the Burmese form 69·91 per cent. of the population of the province, only 46 per cent. of the total patients were natives, and of these the vast majority were out-patients. The chief cause of the prejudice appears to be the want of knowledge of Burmese by the European and Indian doctors. Better things are expected as the number of Burmese doctors increase. An endeavour has already been made to train Burmese doctors by granting scholarships to Burmese students at the Madras and Calcutta Medical Colleges. "The task," the Chief Commissioner observes, "should not be difficult as "the prejudices of the Burmese spring from no caste rules or restrictions, but are "mainly the conservatism of a semi-civilized race which is slow to abandon old habits "and beliefs." The Sanitary Commissioner has been requested to notice specially in his next report the result of the employment of Burman Medical Officers. Of the 15,600 in-patients 11,331 were cured, 793 were relieved, and 1,476 died, the deaths being in the proportion of 94·61 per 1,000 of the total number. A little more than half the deaths occurred in the Rangoon dispensary, which recorded a death-rate of 167·7 per 1,000. Surgical operations continued to increase, those of a major kind having risen from 261 in 1887 to 370, and the minor operations from 5,429 to 7,315.

Central Provinces.

Two new dispensaries were opened in the Central Provinces during 1888, bringing the total up to 104. The number of patients under treatment was 849,965 against 809,064 in 1887, being an increase of 40,901. In-door patients numbered 7,598, an increase of 290 on the previous year, and of these 5,424 were cured and 746 or 98 per 1,000 died, the death-rate being 11·5 per 1,000 less than in 1887. The diseases from which the majority of the patients sought relief were malarial fever, diseases of the eye and of the skin, and ulcers. Of the 37 groups under which diseases are registered, there was a considerable increase of patients in 10, diseases of the eye being the chief, with an increase of 30 per cent. On the other hand cholera cases were less by 90 per cent., bowel complaints by 41 per cent., and diseases of the lungs by 24 per cent. In surgical operations there was an increase of 713, the total being 21,656 against 20,943 in 1887. Of these 974 were major operations, being an increase of about 10 per cent. on the number of the previous year.

Assam.

There were 62 dispensaries open in Assam during 1888, being three more than in the previous year. At these 224,471 patients were under treatment against 189,587 in 1887, showing an increase of 34,884 in 1888. The increase, however, was entirely among out-patients, as the number of in-patients declined from 3,593 to 3,466. Of these 1,810 were cured, 272 relieved, 389 otherwise discharged, and 654 or 188·7 per 1,000 died. In some institutions the mortality among in-patients was very great, the high death-rates being accounted for by the general poverty and consequent debility, along with the gravity of the cases admitted. The Assamese are reported to be averse to operative surgery, still each year shows an increase in operations. Those of a major kind have steadily risen from 148 in 1885 to 448 in 1888, and in the minor operations the figures increased from 4,104 in 1887 to 4,989 in 1888. Dr. Costello instances the good surgical work which used to be done at the Punjab frontier hospitals, which, he says, had a satisfactory political effect

on the border tribes and tribes far beyond, and he thinks that a similar effect could be produced on the Assam frontier. The Chief Commissioner of the Province commends these observations to the earnest attention of all Civil Surgeons and their subordinates.

Madras. The number of civil hospitals and dispensaries in the Madras Presidency increased during 1888 from 344 to 375, and the number of patients from 2,170,287 to 2,308,097. Of these 2,264,650 were out-patients and 43,447 were in-patients, as compared with 2,128,139 and 42,148 in 1887. There has been a steady increase in the annual number of females attending these institutions, which the Surgeon-General with the Government states "is a matter of satisfaction in a country like India, where such obstacles "exist to the extension of European medicine amongst the female portion of the "population." About 35 per cent. of the total number of patients in 1888 were females. The public health was not altogether satisfactory during the year, and there was an increase in the number of cases of cholera, dysentery, and diarrhœa, and rheumatic affections, still mortality from all causes amongst in-patients fell from 71·0 per 1,000 of total treated to 67·8. The principal diseases under treatment were malaria, rheumatic complaints, and respiratory affections. Cases of venereal disease were more prevalent, the number having increased from 44,356 in 1887 to 48,638. "There can be no doubt," the Surgeon-General says, "that much injury is being done "to the health and physique of the civil population by the great and apparently "growing prevalence of syphilis, but no special measures for its extermination seem "practicable beyond encouraging patients suffering from it and other venereal "complaints to seek relief at our civil hospitals." During the year 73,176 surgical operations were performed, being an increase of 9,767 on the number of 1887. The increase, however, was entirely of the minor order, for the major operations declined from 5,154 to 4,960, which was due to the omission of fractures in the list and to their being included under the head of local injuries. Of the major operations the fatal cases were in the proportion of 4·71 per cent against 4·11 in 1887.

Bombay. During 1888 there were 237 public hospitals and dispensaries in existence in the Bombay Presidency, seven of which were new institutions. The number of persons who received medical relief was 1,715,176, of whom 37,248 were in-patients against 37,123 in 1887, and 1,677,928 were out-patients against 1,657,710. Of the total number 48 per cent. were men, 20 per cent. women, and the rest children of both sexes. The diseases from which relief was sought were principally skin diseases, malarial fever, and diseases of the digestive organs; under the first of these the cases increased from 251,635 in the previous year to 280,748, and formed 16·3 per cent. of the total number of cases under treatment. Cholera cases increased from 4,081 to 7,833, of which more than a half occurred in Gujárat. There was also visible increases under small-pox, dysentery, and leprosy, while cases of malarial fever showed a large, and cases of syphilis a small, increase. The results of the treatment of in-patients show that 25,259 were cured and 3,031 died, the deaths being in the ratio of 81·3 per 1,000. The total number of operations performed was 85,186, of which 4,913, including 134 remaining under treatment from the previous year, were of a major kind, and of these 4,146 were cured and 162, or 3·2 per cent., were fatal.

Berar. The same 43 medical institutions were open in Berar during 1888 as in the previous year, but the attendance increased by 8,289, the total number of patients being 256,799 against 248,510. Considering that the year was healthier than 1887, the increase was attributed to the growing popularity of the institutions. The increase in the number of patients, however, was almost entirely of the out-door class, the house-patients having increased to the extent of only 23, viz., from 2,360 to 2,383. Of these 91 were cured and 102 died, the ratio of deaths being 42 per 1,000 as compared with 58 in 1887. As regards the diseases for which treatment was chiefly sought, fevers claimed 41,919 patients against 37,232 in 1887. Diseases of the skin, of the eye, and ulcers also showed an increase, whilst there was a decrease under cholera, diarrhœa, and dysentery. The number of major surgical operations fell from 335 to 218, the decrease being attributed to a stricter classification; minor operations numbered 7,203 against 7,670, showing a diminution of 467, of which no explanation was given.

Lock Hospitals.

Bengal. The number of admissions into the two voluntary lock hospitals of Sealdah and Alipore in 1888 was 2,236 against 2,672 in 1887, the in-patients being 474 as compared with 458.

The reports of the four cantonment lock hospitals in Bengal show an increase in admissions in those at Dum-Dum and Dinapore, and a decrease in those at Barrackpore and Darjeeling. Up to the end of 1888, the orders of the Government of India for abolishing compulsory registration of women had not been carried out at Barrackpore and Darjeeling. The attention of the local authorities has since been drawn to the matter. At Barrackpore the admissions into hospital for venereal diseases per 1,000 of average strength was 165·0 against 512·2 in 1887. No explanation has been given of this great decrease. At Dum-Dum the slight increase in the ratio of admissions from 252·06 to 269·23 per 1,000 was attributed to the abolition of the compulsory registration of women. At Dinapore, the ratio of admissions rose from 99·32 per 1,000 in 1887 to 198·83. It is reported that in a large number of cases admitted into this hospital, the disease had been contracted outside the limits of the cantonment. The admissions into the Darjeeling lock hospital were in the ratio of 216·83 against 341·91 in 1887.

North-Western Provinces and Oudh.

Venereal disease was much more prevalent amongst the troops stationed in the North-Western Provinces and Oudh during 1888 than in the previous year. At the 18 stations where lock hospitals were open, the average strength of the troops was 15,391 against 14,383, and the ratio of admissions for venereal diseases was 391·8 per 1,000 against 309·3, showing a rise of 82·5 per 1,000. In only three stations, Fatehgarh, Chakrata, and Moradabad, was the ratio of admissions below the general average of 1887, whilst Sitapur recorded the high ratio of 702·1, and the garrisons of Cawnpore, Agra, Meerut, Bareilly, Benares, Naini Tal, and Muttra of over 400 per 1,000 each.

As regards the new system of voluntary attendance at lock hospitals, the reports showed a diminution in the number of women on the register of several important stations, and an abnormally low attendance at the monthly examinations. Consequently there was a great decrease in the cases of disease discovered and retained for treatment. A comparison of the returns shows that although the system of voluntary attendance had only been in operation for about four months, the number of cases had fallen from 1,799 in 1887 to 1,470 in 1888. It is reported that under this system "the attendance of women voluntarily for inspection almost entirely ceased at "Allahabad; very few came forward for medical inspection and treatment at Agra; "the attendance became very small at Shahjahanpur; while at Meerut the hospital "remained empty from the 14th September till the close of the year."

Punjab.

Lock hospitals were maintained in the Punjab at the same 16 cantonments in 1888 as in the previous year, but if the use of them continued to be so neglected by women practising prostitution in future as they were in the last four months of the year, after the withdrawal of the Contagious Diseases Act, the Local Government considered it would be desirable as a matter of economy to close them. At eight cantonments the attendance was discontinued altogether after the 1st of September, when the compulsory system was abolished, and at three others during the month of December, while at the remainder, excepting Peshawar and Naushahra, the attendance dwindled down to one or two solitary cases.

Among the European troops the admissions from venereal affections rose from 3,842 or 255·06 per 1,000 of average strength to 4,615 or 321·10. The increase was spread over 9 of the 16 cantonments, chief among them being Delhi, Umballa, Jullundur, Ferozepore, Meean Meer, and Mooltan. In the case of Delhi, the number of admissions into hospital during the last three months of the year exceeded the admissions for the rest of the year. It is noticed that out of the seven cantonments showing a decrease, five are in the hills, "and as these stations are practically denuded of troops during "the last three months of the year, the new policy cannot have materially affected "these cantonments during the year under report." The only cantonment in which there was a very marked decrease was that of Sabathu, where the admissions per 1,000 of average strength fell from 452·48 in 1887 to 177·11 in 1888. In all the other cantonments in which there was a decrease of venereal disease in 1888, as compared with the previous year, the decrease was small. The Officiating Inspector-General of Civil Hospitals, however, considered it inadvisable to draw conclusions from statistics collected over so short a period as four months. "So far, however," he says, "as the "statistics go, they appear to me to point to the conclusion that the abolition of "the compulsory registration and examination of prostitutes has had the effect of "increasing the spread of venereal disease among European troops located in "cantonments within the Punjab."

Lower Burma.

In Lower Burma the enforcement of the rules concerning contagious diseases was discontinued in August 1888, and from that time the lock hospitals were kept open as institutions affording medical relief to those who sought it voluntarily. The attempt to introduce the voluntary system, it is stated, failed. In Rangoon, Bassein, and Akyab, 16 or 17 women applied for treatment. In Thayetmyo and Toungoo the attendance of patients entirely ceased. The hospitals of Akyab and Bassein have since been closed, and the question of closing the other three was under consideration. The lock hospitals were, in fact, practically tenantless. It is reported that among 418 women found diseased at the Rangoon lock hospital during the eight months ending 31st August, no less than 229 were suffering from primary syphilis. As regards the effect of the suspension of the Contagious Diseases Act on the general public of Rangoon, the Superintendent of the lock hospital says: "The number treated at the General Hospital, Rangoon, "has increased by about 600 over last year, and lately there has been a tendency still "to increase. The total treated in September, October, November, and December in "1887 was 586, whilst in the same months of 1888, after abolition of the Contagious "Diseases Act, the total was 856, or an increase of 270 for these four months. Of "course sufficient time has not elapsed as yet to judge fairly of the results of the "abolition among the general population." He also testifies to the increase of disease amongst the troops since the repeal of the Act. "Amongst the European troops," he says, "there is nothing fit to show much difference as far as statistics go. As "pointed out, there is an increase in those treated in the General Hospital, and, as I "can myself state, the form of syphilis is getting worse. Privately I am informed "also that within the last month it has increased, and the type is far more severe,— "to this also I can testify myself." The Superintendent of the lock hospitals at Toungoo, Bassein, and Thayetmyo also reported that cases of venereal disease had increased greatly in number since the suspension of the Act.

Central Provinces.

The statistics of the four cantonment lock hospitals in the Central Provinces for 1888 show that, with the exception of Kamptee, there was an increase of venereal disease among the British troops as compared with the previous year. The following were the ratios of admission per 1,000 of strength:—

—	1887.	1888.	—	1887.	1888.
Jubbulpore - - -	378	493	Pachmarhi - - -	150	475
Kamptee - - -	510	413	Saugor - - -	320	394

It will be seen that there was a considerable decrease in Kamptee, though the ratio was still very high, and that the ratios of the other three stations have largely increased. This was attributed by the Medical Officer at Saugor to the prohibition of registration and of compulsory examination, the orders regarding which were duly carried into effect at all four stations.

Madras.

The Contagious Diseases Act was withdrawn in the Madras Presidency on the 30th June 1888. During the year 464 women were under treatment at the lock hospital. The number admitted in the course of the first half of the year was 305, and under the voluntary system in the second half of the year the number fell to 102, the decrease being accompanied by a great increase in the admissions for venereal diseases into ordinary hospitals. At the close of the year there remained only 39 women under treatment at the lock hospital.

At the eight military lock hospitals the average number of registered women was 445 against 695 in 1887. As a result of the abolition of inspection, the number of women admitted into the hospitals fell from 2,119 to 1,328, and the average number of prostitutes attending the periodical examinations varied during the first eight months of the year between 489 and 491, and in the last four months, after the suspension of the Act, between 74 and 34. The cases of primary syphilis fell from 314 to 83, the decrease being due in a great measure, the Surgeon-General Her Majesty's Forces in Madras states, to Medical Officers having been instructed not to return, as primary syphilis, certain cases which were previously returned under that denomination. "The "total admissions," he says "and the actual number of cases of primary syphilis, are "of course decreased by the abolition of inspection; but the ratio of the latter to the "former, which, at first sight, would not appear likely to be influenced by this cause, "is also considerably diminished thereby. The reason of this probably is that

" gonorrhœa and other affections, whose existence becomes manifest to the diseased " person without inspection, were admitted to hospital, while cases of the more serious " disease, the existence of which is not so obvious without skilled inspection, were not " detected and subjected to treatment in the same proportion as in the admission rates " for former years."

Among British troops at the eight stations where lock hospitals were established, the ratio of admissions for all forms of venereal disease was almost the same as in 1887, viz., 356·41 per 1,000 of average strength against 352·23, the average rate being made up of ratios ranging from 308·14 at Bangalore to 466·66 at Cannanore. Of the total 3,130 admissions, 716 were cases of primary syphilis, which is a large increase on 558 in 1887. If the presumption made above, the Surgeon-General observes, " that a large " proportion of cases of primary syphilis escaped detection, remaining out of hospital " and without any treatment. it would follow that this disease would be propagated " to a larger extent than in previous years. . . . That there was a large increase " in primary syphilis, while the admissions for general venereal diseases maintained " the approximate level of former years, means that the residual venereal diseases, " after eliminating primary syphilis, were much lessened. The obvious cause of this " decrease in the residuum was that primary syphilis masked the less acute affections " for which there would have been admissions, if the more severe disease had not " predominated and denominated the admissions."

Bombay.

The operation of the Contagious Diseases Act in Bombay was suspended from the 1st July 1888. Lock hospitals were maintained at 13 stations in the Bombay Command during 1888, and at these the admissions from venereal disease amounted to 3,462 or 342·26 per 1,000 of a strength of 10,232. At the several lock hospitals the ratios ranged from 120·79 in Karachi to 691·45 in Ahmedabad. The total strength of British troops in the Command during the year, according to the Surgeon-General's report, was 11,925, among whom there were 4,274 admissions from venereal affections, the ratio of admissions per 1,000 of strength being 358·40, against 255·52 in 1887. This large increase was partly due to the inclusion with the classified diseases of others of venereal origin; but even excluding these the ratio (293·25) was higher than that of the previous year. The increase of venereal disease was generally ascribed to the abolition of the rules for the registration and compulsory examination of women and their detention in hospital. As regards the voluntary system of examination, it is reported that though a number of women continued to present themselves for examination at some stations, many of those found diseased would not remain in hospital, while some only attended for treatment as out-door patients.

Lunatic Asylums.

Bengal.

There were 1,160 lunatics under treatment in the five asylums of Bengal during 1888, being an increase of 23 on the number of the previous year. Of these 238 were fresh admissions, exceeding those of 1887 by 57. In the course of the year 67 were discharged cured, 45 were reported improved, and 13 not improved, and 74 died. Regarding the causes of insanity the Inspector-General of Hospitals states " that " ganja smoking is by far the most prolific cause of insanity in Bengal, and it would " seem that when the drug is not smoked it is comparatively innocuous. It seems " also that spirit drinking gives rise to more mental disease at Patna than in any " other asylum of the province. Among the moral causes grief is the chief." Except at Patna there was less sickness among the inmates of the asylums, but the increase at Patna was not so great as to deprive the asylum of the reputation of being the healthiest in the province. Fever, as usual, was the chief cause of sickness at nearly all the asylums. Only at Dullunda was there any cholera, and here 6 cases occurred, 2 of which proved fatal. The death-rate of the asylums per 1,000 of average strength fell from 91·1 in 1887 to 79·3. The diminished mortality was mostly due to fewer deaths from dysentery and diarrhœa, and also to the comparative absence of epidemic disease. There was a very large increase in the criminal population of the asylums, 384 individuals constituting this class having been in confinement at the beginning of the year, and 418 at its close. The admissions and re-admissions increased from 80 and 10 respectively to 99 and 20. The number discharged in 1887 (75) showed a diminution of 14, while the deaths (28) were less by 4. For some years this class of lunatics has been increasing, and it remains to be seen whether the new system of discharging after recovery, which was recommended by a special committee and approved of by the Government, will have the effect of reducing the number of admissions.

In the European Asylum at Bhowanipore 50 lunatics were under treatment, 19 of whom were admitted during 1888. Of these 15 were discharged cured, 3 were despatched to Europe, 1 was transferred to the care of friends, and 2 died. The daily average strength was 32, against 29 in 1887. The Inspector-General reported favourably of the sanitary condition of the asylum and of the care and attention bestowed on the inmates.

North-Western Provinces and Oudh.

The daily average strength of the four asylums (Agra, Bareilly, Benares, Lucknow) in the North-Western Provinces and Oudh during 1888 was 1,011, being 47 more than in 1887, and of this increase Benares contributed 43. It is stated that "the admissions from the head-quarter districts in which the asylums are situated "continued to be out of all proportion to the admissions from out districts, and the "Inspector-General of Civil Hospitals was of the opinion that sufficient care was not "exercised in the matter by the Superintendents and District Magistrates; but it must "be remembered that the asylums were in every case at the centre of a large town "population. It was shown that labourers and cultivators, who formed nearly three-"fourths of the total population, only contributed one-third to the number of lunatics, "whereas the remaining two-thirds of the lunatics were drawn from the remaining one-"fourth of the population. There appeared therefore to be grounds for the belief that "the classes who lived in towns were very much more liable to mental disease than those "who lived in rural districts, and this probably in part explained the number of admis-"sions at Lucknow and Benares, though it did not account for the fact that, at the "comparatively unimportant town of Bareilly, the number of admissions continued to "be the highest in the provinces." There was again excessive sickness and mortality at the Lucknow asylum. Measures have however been taken by which sickly lunatics, if violent, are transferred to other asylums, and, if harmless, sent back to the districts from which they originally came. Important reforms were effected during the year with the object of avoiding the overcrowding with which the asylums were threatened by the steady annual increase in the number of their patients. The Inspector-General estimated that the combined space in all the asylums could not accommodate more than 1,143 inmates, and that limit had already been more nearly approached than was convenient; but the arrangements which have been sanctioned will, it is hoped, provide sufficient relief for the next 20 years.

Punjab.

The statistics of the two asylums (Lahore and Delhi) in the Punjab show that 455 lunatics were under treatment during 1888 against 487 in the previous year, being a decrease of 32. The admissions to both asylums in 1888 were 103, or 7 less than they were in 1887. Of the total number 78 were discharged and 27 died.

An analysis of the alleged causes of insanity was made in accordance with the wishes of the Government of India, in order to show the number of cases which had resulted from the abuse of intoxicating drugs and spirits, when it was found that Indian hemp, particularly in the form of charas had been the most potent of the alleged causes of insanity. The health of the lunatics in both asylums improved from what it was in 1887, though it was not considered satisfactory. In the Lahore asylum the daily average sick declined from 36·85 to 19·89, and the deaths from 37 or 138·8 per 1,000 of average strength to 13 or 50·6. In the Delhi asylum there was less sickness with slightly increased mortality, the deaths having risen from 13 or 129·9 per 1,000 to 14 or 150·4. Epidemic disease was absent from both asylums.

Lower Burma.

In the Rangoon lunatic asylum the number of patients continued to increase. On the 1st January 1885 there were 182 lunatics under treatment, and on the 1st January 1889 the number had reached 233. The total population of the asylum in 1888 was 323, including 96 new admissions and two re-admissions. Of this number 60 were discharged in the course of the year, 43 as cured, and 30 died. The health of the asylum was very unfavourable, the admissions to hospital having risen from 99 in 1887 to 132, and the daily average number of sick from 12·39 to 15·44, while the mortality (130·1 per 1,000) was the highest since 1881. Cholera was the chief cause of mortality, and though the epidemic only lasted from the 8th to the 30th July, the attack was virulent and 8 deaths took place. Dysentery and tubercle caused 7 deaths each, and debility 4. The majority of the deaths (70 per cent.) occurred among lunatics who had not been in the asylum more than three years. Of the 30 deaths 14 were recorded as being in bad health, 10 in fair health, and six in good health on admission into the asylum.

The number of patients under treatment at the two lunatic asylums in the Central Provinces during 1888 was 316, of whom 159 were inmates of the asylum at Nagpur and 157 of that at Jubbulpore. The proportion of cases cured was 15 out of 25 discharged. As in previous years the large majority of the lunatics admitted at Nagpur were suffering from mania or dementia, and at Jubbulpore from acute mania. In the Nagpur asylum sickness was more prevalent than in the previous year, but it was of a less severe type, for the deaths declined from 25 or 180·0 per 1,000 of average strength to 12 or 91·2. In the Jubbulpore asylum also there was slightly more sickness, with a decrease in the deaths from 9 or 66·3 per 1,000 to 7 or 49·5. In consequence of the great difference in the vital statistics of these asylums in previous years, especially in respect of bowel complaints, the Government of India suggested an assimilation of the diet scales. The assimilation, however, has not as yet affected the relative statistics of the two asylums. "From a comparison of the asylum returns of "other provinces," the Local Government observe, "with those now under review in "respect to the statistics of sickness and mortality, it appears that though the per- "centage of sick to strength is low in the Central Provinces, the mortality is markedly "high and is mainly attributed to fever and anæmia. It would appear that the "classes which feed the jails and asylums are of distinctly lower physique than the "corresponding classes in Upper India and even in Bengal. There is no other "explanation to be given of the difference in results. No greater care could be taken "of lunatics anywhere than is devoted to them in the asylums of the Central "Provinces." Central Provinces.

The number of lunatics under treatment in the Tezpur Asylum, Assam, during 1888 was 108, of whom 32 were new admissions and 3 re-admissions. By the end of the year the population was reduced to 83 by 15 discharges (10 as cured), 3 escapes, and 7 deaths. In the previous year there were 105 inmates, 35 being new admissions. There was thus a slight decrease in the number admitted in 1888. Notwithstanding, previous statistics showed a yearly increase, chiefly amongst the "imported coolies," which was attributed to the increase in this class of labourers in Assam and to their "well known addiction to intoxicating drugs, &c." The different preparations of Indian hemp were reported to have been the chief physical causes amongst the inmates of the asylum in 1888, followed by spirit-drinking and opium. Moral causes accounted for less than a third of the known causes. There was more sickness in the asylum than in 1887, the daily average sick having increased from 2·94 to 5·96; on the other hand the mortality was not so high, the deaths having decreased from 11 or 154 per 1,000 of average strength to 7 or 84 per 1,000. Of the 40 patients who were admitted to hospital during the year 17 were among the new admissions, and of these 8 were sent straight to hospital on the day they entered the asylum. Assam.

At the three asylums in the Madras Presidency (Madras, Vizagapatam, and Calicut) the lunatics under treatment in 1888 numbered 795, or two less than in 1887. The admissions, including re-admissions, amounted to 168, being 39 less than in 1887. In the course of the year 61 were cured, 27 transferred to the care of friends, 21 otherwise discharged, and 39 died. The most common forms of insanity treated were mania, of which there were 320 cases, dementia, and melancholia. At the close of 1888 there were 647 cases remaining in the asylums, an increase of 20 over the number remaining at the end of the previous year. Madras.

As in previous years, there was a large number of soldiers admitted. As many as 29 per cent. of the male admissions were British soldiers or Sepoys, this high proportion being attributed to the fact that insanity occurring in the army is speedily detected, and at once subjected to treatment. On the whole the health of the patients was very good, and the asylums were free from epidemics. The deaths fell from 46 or 74·0 per 1,000 of average strength to 39 or 60·4.

At the beginning of 1888 there were 134 criminal lunatics under treatment, 22 were admitted during the year, making a total of 156. Of these, 9 were discharged and 5 died, leaving at the end of the year 142.

The accommodation was again found inadequate, and some criminal lunatics were accordingly confined in jails. The question of the best manner of providing increased accommodation in all three asylums was under the consideration of the Government.

The total population of the six lunatic asylums in the Bombay Presidency during 1888 was 949 against 913 in 1887. The admissions, including re-admissions, amounted to 266, and the discharges to 188; of the latter all but 20 were wholly Bombay.

or partially cured. At the close of the year there remained under treatment 675 against 683 in 1887. As far as ascertained the causes of lunacy were chiefly physical, the commonest being the abuse of intoxicating drugs or liquors. There was more sickness among the lunatics than in the previous year, and the deaths rose from 54 or 79·5 per 1,000 of average strength to 86 or 126·6. Of the 86 deaths, 51 occurred at Colaba, an increase of 18 on the mortality of the previous year, which was due to prevalence of cholera and diarrhœa. The Surgeon-General was unable to assign any reason for this result, but the Medical Officer in charge was of opinion that a greater number than usual of debilitated patients was admitted. Among the inmates of the asylums were 123 criminal lunatics, of whom 22 were fresh admissions. The year closed with 101 under confinement, 7 having been discharged and 15 having died.

Medical Schools.

Bengal.

The total number of medical students in Bengal at the close of the session of 1888–89 was 999 against 887 in the previous year. On the opening of the session in the Calcutta Medical College, 160 students continued their studies, 16 rejoined, and 51 new students were admitted, making a total of 227 against 254 in 1887–88. At the close of the session the strength was reduced to 148. For the First M.B. examination 8 students passed—1 in the first and 7 (including one female) in the second division; 7 candidates passed the Second M.B. examination, and 11 candidates passed the First, and 15 the Second L.M.S. examination. There were 24 female students in the college, five of whom were reading for the University degree, and 19 attended the special certificate class. The Campbell Medical School had 220 students on its rolls. Out of 82 second-year students who appeared for the first license examination 78 passed. For the second or final license examination 59 third-year students appeared and 50 passed. Of 79 first-year students 60 received promotion. There were 14 first-year female students at this school, 10 of whom obtained promotion, and one was ordered to be re-examined after an interval of three months. At the Dacca Medical School there were 205 pupils on the rolls at the close of the session. In the final examination 52 students out of 63 failed, and in the junior diploma examination 79 second-year students appeared, of whom only two failed. The Temple Medical School had 121 students on its rolls at the close of the session. Out of 31 third-year students 20 passed and 2 were recommended for re-examination, and of 37 second-year students 18 passed and 7 were recommended for re-examination. At the Cuttack Medical School there were 53 students at the close of the session—23, including 3 females, being in the first class, 19 in the second class, and 11 in the third class. In the third class there were 2 females, one of whom passed third out of the 11 students, and the other left in the course of the year to be married.

North-Western Provinces and Oudh.

The number of pupils at the Agra Medical School rose from 173 in 1887–88 to 196 in 1888–89, of whom 39 were females against 51 in the previous year. The results of the examinations were again satisfactory. In the first, or senior class, comprising third-year military and fourth-year civil students, there were 28 candidates for final examination, and 23 passed. The Inspector-General of Hospitals was glad to be able to testify from personal observation to the general excellence of the qualifications of these students. The civil pupils did best in the examination and carried off both medals; but the military pupils whose course is composed of three years spent continuously at the school, though slightly inferior in the matter of marks, were said to be practically equal in professional qualifications to the civil students of four years standing, who, after one year at the school, are by existing practice attached to the different hospitals in the province for one year, returning at its close to the school for two years. In the second class of males, comprising second-year military and third-year civil students, 25 out of 28 passed. The third and fourth, or junior classes, embrace the first-year students, of whom there were 59. The results of the sessional examination of this class were also satisfactory. Considerable progress was made in the female classes. The decrease in the number of students from 51 to 39, which was due to fewer girls being admitted, was not regretted, the accommodation and facilities for teaching being such as to preclude the admission of more.

Seven girls received their diplomas and license to practice. The examination lists showed that the female students obtained quite as good marks as the young men. Those of the second class, although they had a heavy subject, midwifery, were con-

sidered to have done better. Of 13 who presented themselves for the first professional examination 9 passed, and 4 did fairly well. "As far as we have gone yet," the Inspector-General of Hospital says, "and we have now gone far enough to be confident "in our expectations, the work *in practice* of the young women who have left the "school fully bears out all we ventured to hope for it." The Lady Lyall Hospital, which is now open, affords ample opportunities for clinical instruction, and the completion of the lying-in hospital will give great facilities for practical instruction in midwifery cases. "Efforts are being made," it is stated, "to induce Hindu women to "come forward and compete for the scholarships which have been offered by various "municipalities in these provinces, and it is to be hoped that the prejudices which "still exist among this class of the community, and among Muhammadan women of a "respectable class, may gradually be overcome. If these efforts be only successful, "further and substantial progress may be expected, for it is with this initial difficulty "of attracting pupils that this branch of the school has had to contend."

Punjab.

The number of scholars attending the Lahore Medical College and School during 1888–89 was 254, of whom 85 (including 4 females) were in the college department, and 169 (including 15 females) were in the school, against 61 and 134 respectively in the previous year. This shows a considerable increase, and concurrently with this increase, the Director of Public Instruction reports, "there has been a decided "advance in the preliminary education. Before 1887–88, the highest qualification "possessed by any of the candidates for admission into the college was their having "passed the University Entrance Examination. In the year 1887–88, two were "admitted who had passed the Intermediate Examination in Arts of the Calcutta "University; while on 1st April 1889, 8 candidates who had passed that examina- "tion, and one who had taken the degree of Bachelor of Arts, were admitted into the "college classes. And with regard to the students who enter the schools, the "Principal reports that while none are admitted into the military or civil medical "pupil class who have not passed the Anglo-Vernacular Middle School Examination, "many of those who join the civil division have, of late, shown a good knowledge of "English. The bare statement of these facts proves satisfactorily, in my opinion, the "growing popularity of the Lahore Medical College and School, the spread of educa- "tion among the people, and an increasing desire on the part of the rising generation "to embrace the medical profession as a career in life." For the final examination of the Punjab University, 11 college students appeared, 8 of whom passed; and at the junior examination in medicine, 4 out of 12 candidates passed. In the Medical School 20 out of 27 candidates passed as Hospital Assistants and Native doctors.

Madras.

The strength of the Madras Medical College rose from 295 in 1887–88 to 344 in 1889. In the L.M.S. classes the number of pupils rose from 110 to 118, but in the M.B. classes it fell from 15 to 14. At the close of the year there were 39 female students under instruction against 21 on the 31st March 1888, and of these 4 were in the L.M.S. section. The results of the University examinations were satisfactory so far as the M.B. and Second L.M.S. students were concerned; in the other examinations less than 25 per cent. were successful. At the First L.M.S. examination there was a large number of failures (only 14 having passed out of 55 candidates), chiefly in the subjects of physiology, anatomy, and chemistry. One female proceeded to the degree of M.B., being the first lady who has taken that degree at the Madras University.

The number of pupils attending the three medical schools of the Presidency, viz., the Madras Medical School, the Nellore Board Medical School, and the Prince of Wales' Medical School, Tanjore, was 225 against 196 in the previous year. The increase of 29 was confined to the Madras Medical School, the numbers in the other two being the same (17 and 31 respectively) as in 1887–88. At this school for the primary and final examinations for the apothecary grade certificate respectively, 5 and 4 female candidates presented themselves, and all were successful; and out of 58 students that appeared for the final examination of the hospital assistant's grade only 42 passed. At the annual examination for Hospital Assistant's grade at the school at Tanjore 13 students appeared and 12 passed.

Bombay.

The attendance at the Grant Medical College, Bombay, decreased from 219 at the close of the session of 1888 to 182 at that of 1889. The reduction in the number of students was attributed to the fact that the medical profession in Bombay is overstocked, and the Principal, so far from regretting the falling off, had hopes of

inducing the University to make a further reduction by raising the standard of admission to the college. For the first examination in medicine there were 55 candidates, of whom 21 passed; for the second examination only 9 candidates out of 55 passed; and for the L.M.S. degree there were 73 candidates, of whom 39 passed. The Principal of the college reported favourably of the ladies (18) in the University classes, but less so of the students (15) in the certificated practitioners' class for women. Two of the latter passed the final examination and obtained certificates, and one soldier's wife joined the European midwife class.

It has been decided to build on a site in the compound of the Grant Medical College, at a cost of Rs. 30,000, a Home for Nurses or Pupil Nurses. Half of this sum is the gift of Mr. Mancherji M. Bhownaggree, C.I.E., in commemoration of his late sister. The home is to be called Avabai Bhownaggree Home for Nurses, and it will be kept in repair by Government.

At the Government Medical Schools at Poona, Ahmedabad, and Hyderabad, the number of pupils was 142, an increase of 30 on the previous year. At the final examination 34 students, including 4 females, passed out qualified, the women as midwifes.

VII.—SANITATION.

The most important event from a sanitary point of view in Calcutta during 1888 was the completion of the works for doubling the water supply of the town, at a total cost of Rs. 61,75,600. This amount includes Rs. 7,50,000, the cost of the unfiltered supply extension. "The completion of this great undertaking," the Chairman of the Calcutta Corporation states, "has passed almost unnoticed, yet it has taken fully ten years "to overcome the difficulties—financial, administrative, and engineering—which have "beset it." In 1885–86 the daily supply of filtered water was limited to 8,106,000 gallons, it now exeeds 16½ million gallons. The daily supply per head of population now amounts to 40 gallons of filtered water and 7½ gallons of unfiltered water. Active arrangements were made for the extension of the supply to that portion of the added suburban area which will be dependent for its water on the Calcutta mains. Satisfactory progress was made in the improvement of bustees. In four cases improvements were completed, in two they were nearly completed, and in four they had been commenced. The work of tank-filling was progressing. The chief works of drainage under execution during the year were the roads and sewers in the Baug Bazar and two other areas, all of which were approaching completion. Over two miles of pipe sewers were constructed, bringing the total length up to 146·7 miles. There were 805 premises connected with the sewers during the year, making a total of 24,654. Bengal.

Another sanitary measure of some importance executed in Bengal during 1888 was the completion of the Dinagepore drainage scheme at a cost of Rs. 23,884. The municipalities of the province spent about 5½ per cent. of their income on sanitation; but of the total outlay of Rs. 16,81,703, about a third was expended on the construction and repairing of roads. Compared with the previous year there was an increase of expenditure under all the chief heads, except drainage, which was less by Rs. 12,130. Drainage being one of the most urgent and pressing wants of the province, the Lieutenant Governor trusted that in future municipalities would recognise the desirability of devoting a larger percentage of their income to this object. Dr. Gregg states that in many cases the municipal income is injudiciously laid out, and that much money is wasted on temporary works and works of minor importance which might with greater advantage and profit be laid out on works of a more needed, substantial, and lasting nature, such as drainage, water-supply, and public latrines. Still he thinks that, as a rule, Municipal Commissioners are anxious to do all they can for the benefit of the towns under their care. In addition to the sum spent by the municipalities Rs. 5,16,374 were expended in the interior of the districts in providing bridges and culverts, in extending water-supply, and other sanitary measures of more or less importance. Rs. 2,37,661 were also spent by charitably disposed persons on similar work. During the year the Sanitary Commissioner visited a number of towns, when he made such suggestions as he thought necessary, and since the close of the year he has addressed circulars to municipal authorities on the subjects of drainage, water-supply, and conservancy.

In pursuance of the policy laid down in the Resolution of the Government of India of 27th July 1888 (*see* Vol. XX., p. 38), the Lieutenant-Governor intended to appoint a Provincial Sanitary Board, consisting of the Sanitary Commissioner to Government and a Sanitary Engineer as members, with the Junior Member of the Board of Revenue as President, the Engineer to be selected from the Public Works Department.

Sanitary work in the North-Western Provinces and Oudh appears to have received more attention in 1888 than in previous years, and the Government of India were satisfied with the activity which is now being displayed by the leading municipalities. Among the more important sanitary works executed or undertaken during the year the following may be mentioned. At Dehra the supply of pure water from the Nala Pani spring was accomplished at a cost of Rs. 12,000. At Allahabad two drains were completed, and a scheme for the better conservancy of the city by means of Shone's ejectors was in preparation; plans and estimates for new waterworks, at an outlay of Rs. 15,40,000, were also submitted to Government for sanction. At Benares, where the conservancy arrangements are reported to be "scandalously bad," water-supply and drainage schemes had been elaborated and were estimated to cost 40 lakhs. These projects had been carefully considered, and the municipal board had received satisfactory assurances of Government aid to meet the large immediate outlay. The Lieutenant Governor thinks that the completion of these two schemes will result in a North-Western Provinces and Oudh.

marked improvement in the death-rate of the city, which in 1888 was 43·05 per 1,000. At Lucknow progress was made in boring the artesian well, which had reached a depth of 676 feet. At Sultanpur the main drain of the town towards the Gumti was in course of construction, and provision had been made for re-constructing the public latrines. At Fyzabad a scheme for supplying pure water to the city was under consideration.

There is little to notice in connexion with village sanitation. The subject, Dr. Richardson states, "continued to engage attention." In pursuance of the instructions of the Government of India a Sanitary Board has been nominated, and its members were engaged in preparing a practical scheme of operations for the sanitation of towns and the drainage of rural areas more especially liable to malaria, the necessary funds being reserved for their disposal. "Sanitation," the Lieutenant Governor observes, "whether "in towns or rural areas, is still in its infancy in these provinces, and all that can be "done at present is to lay foundations on which more solid work may in later times "be accomplished."

Punjab.

The only sanitary works of any great importance in hand during the year were the filling in of the Amritsar ditch, on which Rs. 2,11,338 were expended, and the Gujranwala drainage scheme, on which Rs. 31,300 had been spent at the close of the year. Several large projects were sanctioned during the year, and were about to be taken in hand. Among them were a conservancy tramway for the city of Delhi, to cost Rs. 50,000, and the waterworks scheme, at a cost of 10¼ to 11 lakhs of rupees; a drainage scheme for the city of Ludhiana, at an estimated cost of Rs. 14,616, and a water-supply scheme for the city of Peshawar, at an estimated cost of Rs. 3,14,000, which was to be taken in hand as soon as the application for a loan of a lakh and a half was sanctioned. The total amount spent by the municipalities on sanitation was Rs. 9,32,043, equal to about 28 per cent. of their actual income. The income realised from the sale of manure by the several municipalities amounted to Rs. 105,221 against Rs. 99,319 in 1887. A number of towns and villages were inspected during the year, 36 municipal towns and 55 villages by the Sanitary Commissioner, and 127 municipal towns besides 3,080 villages by the Civil Surgeons; and it is reported that in the majority of the large municipal towns drainage schemes were in progress, while some had a fair system of drains in them, but that with few exceptions the disposal of the liquid sewage was very faulty. "The question of village sanitation," the Officiating Sanitary Commissioner says, "is far more difficult than that of towns, "and it will require a long time to overcome the habits and customs which "generations of Punjab agriculturists have followed. The conditions in and around "many villages which I have visited are so bad as to create a feeling of wonder how "human beings could continue to preserve health under such circumstances; but the "villagers themselves look upon these arrangements with anything but disgust, "although, if asked, they will readily admit that they are bad and objectionable."

The question of the establishment of a Sanitary Board in the province in accordance with the directions of the Government of India in their Resolution of 28th July 1888 was referred to a committee.

Lower Burma.

The drainage scheme of Rangoon was the only sanitary work of any great importance in hand during the year. The contractors, Messrs. Shone and Ault, were making good progress with it, and it was expected that the night conservancy of a portion of the town would shortly be worked on the pneumatic principle, and then, the Sanitary Commissioner says, water under pressure can be distributed to the higher parts of the municipality and to the cantonments if desired. It remained a question what action the military authorities intended to take in connexion with this scheme. A suggestion was made that it should be extended to the barracks and to the sudder bazaar. The Government of India had invited the attention of the Military Department to the matter and also to the subject of the removal of nightsoil from the Rangoon cantonment.

The municipalities devoted Rs. 19,71,674 or nearly 29 per cent. of their year's income to matters connected with the public health, about two-thirds being expended on drainage works. Of the total sum Rs. 12,71,000 were from the loan raised for Rangoon drainage. Besides this the Public Works Department spent Rs. 93,863 on different items of sanitation, the greater portion (Rs. 64,878) on markets.

At the close of the year a Sanitary Board was constituted in accordance with the recent Resolution of the Government of India. The members were engaged in collecting particulars as to the sanitary condition of rural areas, and they were expected shortly

to submit proposals for commencing work. The question of sanitation in the chief municipal towns also received attention during the year. As it was found that the cost of a sanitary survey would be greater than any except the larger towns could afford it was proposed that the survey should be confined to nine, at an estimated cost of Rs. 10,000 for each town, half of the amount to be borne by Government. It was expected that the survey would shortly be commenced.

Central Provinces.

No sanitary measures of any great importance appear to have been carried out in the Central Provinces in 1888 beyond the construction of 185 new wells. The municipalities expended about 38 per cent. of their income on matters connected with the public health, nearly a half being devoted to conservancy. The Chief Commissioner says: "All that can be done is being done to familiarise the people " with the practice of sanitary principles. Hitherto one difficulty has been that there " existed no adequate machinery for enforcing the observance of such rules outside " municipal areas. In the Municipal Bill now before the Legislative Council provision " has been included for partially supplying this defect in the case of small towns and " the larger villages. In the case of other villages the action of the village mukaddam " in connexion with sanitary matters is also being stimulated by an amendment of " the rules under section 137 of the Land Revenue Act." As regards the constitution of a Sanitary Board in the province the general opinion of officers consulted in the matter appeared to be that it would be a hindrance rather than a help. What was required, in the opinion of the Chief Commissioner, in a small administration like the Central Provinces was, that the Sanitary Commissioner should be head of an executive department of the administration, and, subject to the Chief Commissioner's control, should issue orders where he had hitherto only made suggestions. The Superintending Engineer of the province would be at hand for reference in all matters requiring engineering skill or advice, and through him the services of the Executive Engineers and other officers of the Public Works Department would be made available for the consideration of local schemes. In consenting to this organization the Government of India impressed upon the Chief Commissioner that the principle of a Provincial Sanitary Board should be borne in mind, and, as far as possible, adhered to by associating the Sanitary Commissioner with the Superintending Engineer as a Board for the purposes indicated in their Resolution.

Assam.

No sanitary work of any great importance was carried out in Assam during 1888, but in the larger towns more or less was done to improve their sanitary condition. The municipalities spent 55·37 per cent. of their income on sanitary works. Rural sanitation was receiving attention. A Sanitary Board has been established, which the Government of India hope will, with the co-operation of local boards, succeed gradually, as funds become available, in introducing sanitary reform of a generally useful and far-reaching character in the rural and urban areas of the province. At the close of the year the Chief Commissioner issued instructions to district officers for improving the sanitation of villages, directing their attention specially to the provision and protection of water-supply, the establishment and maintenance of a proper system of drainage, and the prohibition of the deposit of manure and other refuse in places where they might be a source of danger to public health.

During his tour of inspection Dr. Costelle visited the jails of the province, when he found that the sanitary and other arrangements were on the whole satisfactory. He also inspected the dispensaries and tea gardens. Of the latter he speaks in very favourable terms. "I think," he says, "from all I saw in my inspections, that tea " garden managers generally do everything possible to improve the health of the " coolies employed on their gardens."

Madras

In the Madras Municipality nearly 10 miles of drains of all sizes were constructed during 1888–89, making a total of 66½ miles. Considerable additions were also made to the water-supply system of the town, but the water from the Red Hills Lake had been pronounced upon chemical analysis to be bad. With the view of improving the supply, a Bill for the levy of a tax on tobacco consumed in Madras to enable the Commissioners to raise the necessary funds was under consideration, the Government having consented to legislate in the matter.

No new sanitary works of any magnitude were executed in the Presidency either by the municipalities or district boards, but much was done in improving tanks and wells, and in constructing and repairing latrines, drains, &c. Out of an estimated income of Rs. 19,88,130 the municipalities set apart Rs. 6,81,294 for sanitary purposes.

Of this amount, however, only Rs. 4,33,187 were spent in the nine months ending December 1888, leaving more than a third to be expended in three months. The same thing occurred in the Local Fund Circles, where only Rs. 2,61,862 were expended during nine months of the year out of a sanctioned allotment of Rs. 4,85,357. Of the previous year's allotment the sums of Rs. 69,315 and Rs. 76,234 respectively remained unexpended at the end of the year. The attention of the authorities has again been directed to the desirability of utilising the whole of these annual grants for the purposes for which they were intended. During the year the Sanitary Commissioner inspected a number of municipal towns, when he pointed out their chief sanitary defects, and the way in which they could most easily be remedied. The most urgent needs of nearly all the towns are, it is reported, a supply of good water and comprehensive drainage schemes. The chief difficulty appears to be in the want of skilled agency in the preparation of designs, &c., but this will now, it is hoped, be supplied by the appointment of a special Sanitary Engineer, who with the Sanitary Commissioner constitute the Sanitary Board of the Presidency.

Bombay.

In the Bombay Municipality good progress was made during the year with the dam works of the Tansa Lake, and at the end of the year the dam was raised within 44 feet of the final level aimed at. In connexion with the duct works considerable progress was made in pipe laying; 4,800 lineal feet were tunnelled, and four miles of main were laid and jointed. Measures for stopping leakages in the waste weir of the Tulsi Lake and the Bhandarwada and Malabar Hill reservoirs were completed. The laying of the Arthur Road 27 in. main, which forms the last link of the Tansa main, was completed on the 31st March 1889. Its total length is 14,338 feet. Exclusive of this main the total length of new mains laid during the year was nearly eight miles. The number of new connexions made was 962, bringing the total up to 16,098. In various parts of the city sewerage works were either completed or were in course of construction. Plans and detailed estimates amounting to Rs. 2,48,642 were submitted for making house sullage connexions in the quarter of the town called Agripada, and the Government of India have since authorised the raising of a loan of Rs. 2,48,000 for the purpose.

The other municipalities of Bombay expended a fair share of their year's income on conservancy arrangements. In most of the towns works for improving latrines, culverts, gutters, wells, tanks, roads, &c. were carried out. Of the more important sanitary works executed or undertaken, a water-supply scheme for the municipality of Ahmedabad was sanctioned, and the municipality voted a sum of Rs. 1,50,000 for drainage work and sewage farm. At Nadiad a drainage project which had been approved by Government was under consideration. At Dakor a scheme had been prepared for surface drainage and metalling of the main roads, at an estimated cost of Rs. 18,000. The "Dedargaon" waterworks scheme for Dhulia was sanctioned. The Karachi drainage scheme was still under consideration.

During his tour of inspection Dr. Macrury visited most of the districts of the Presidency, and found many of the municipal towns in a bad sanitary condition. Two of the worst cases appear to be Broach and Surat. Regarding the first of these, he says its sanitary condition has been defective for many years, and this is unfortunately borne out by the manner in which cholera clings to it. "Everything connected with "the sanitation of Broach must be re-organised, and a proper commencement made "before any satisfactory result can be expected." Of Surat he says that its sanitary condition is notorious, and cannot, he fears, be remedied by the municipality unaided and alone. The sanitary condition of Broach has already been considered by the Government, who hope "that, after the warning which has been conveyed to the "municipality, the Commissioners will see their way to take more interest in the "proper sanitation of their town, and to recognise more fully their individual "responsibilities with regard to it." In the case of Surat, the Government observe: "Possibly the necessary measures for the improvement of this town are such as "cannot be carried out by the municipality unaided, but it is not to be expected that "they should be taken in hand by Government, unless the municipality renders that "assistance which, up to the present time, it has persistently, and to its great discredit "refused to afford."

The Government of Bombay object to the principle of a Sanitary Board, thinking that India is not advanced enough to profit by such elaborate machinery, and they have directed the attention of the Government of India to the very energetic action already taken in that Presidency. The Government of India, while admitting the good work done in Bombay, have suggested a somewhat modified arrangement, which is now under the consideration of the Government of Bombay.

Neither in the municipalities nor in the districts of Berar were any large sanitary works undertaken. Out of an income of Rs. 1,55,627 the municipalities spent 57·3 per cent. on sanitary measures, more than a third of the latter (22·8 per cent.) being devoted to conservancy. In the districts, excluding municipalities, the expenditure on sanitary improvements was Rs. 1,05,476, of which 28 per cent. was spent on conservancy, 21 per cent. on drainage, and 20 per cent. on water-supply. During 1888 a sanitary survey was made of several towns. Dr. Little reports that it is only in municipalities that any regular system of conservancy exists, and that in no town is there any system of drainage. He greatly feared that unless the municipalities got assistance from Government by a loan on easy terms this urgent sanitary work could not be carried out to completion anywhere in the immediate future. The Commissioner in his letter forwarding the Sanitary Commissioner's report to the Resident at Hyderabad, makes some practical suggestions in regard to future sanitary work. "The policy to be inculcated on municipalities," he says, "is, I think, first to obtain "a thoroughly effective plan, and then to apply year by year a definite sum to its "completion. And in the meanwhile, many minor but useful reforms can be "accomplished by good administration and supervision, such, for instance, as the "selection of a certain number of wells to be used exclusively for drinking purposes, "and to be protected from contamination by the methods recommended by the Army "Sanitary Commission." Sanitary reform in rural areas being a notoriously difficult task, he thinks the work must be undertaken by the district and taluk boards as soon as they have settled down to their new duties, and he directs their attention first to the appropriation of selected wells in each village for drinking purposes, and next to the provision of land for public resort. The Resident concurred in the Commissioner's remarks, and commended them to the notice of District Officers. Berar.

The Resident at Hyderabad has not considered it necessary to form a Provincial Sanitary Board for a small province like Berar, but he has issued instructions for the creation of a Sanitary Board for each district with subordinate Local Boards for each village not being a municipality.

Military.

The total expenditure on military sanitary works in the Bengal Presidency during 1888–89 was Rs. 56,13,362, being 3,61,321 less than in the previous year. No details of work executed or in hand were available at the time of the publication of the report of the Sanitary Commissioner with the Government of India, but the amount appears to have been spent mainly on works for securing the health and comfort of European troops serving in India. Bengal.

In the Madras Presidency various improvements in drainage, water-supply, and barrack accommodation were carried out during 1888. At Bangalore steps have at last been taken for improving the water-supply. An Order of Government, dated 8th January 1889, has approved of a proposal that the supply be obtained from sources outside the cantonment, and estimates were being prepared having that object in view. With the intention of putting the water-supply of Bellary upon a more satisfactory basis, a committee had been ordered to assemble for the purpose of submitting some definite proposals for its improvement. Various measures were proposed by the Surgeon-General of Her Majesty's Forces in the Madras Command for improving the Secunderabad cantonment. A thorough system of surface drainage, he says, is strongly recommended as a means of reducing the serious diseases and mortality of this station. Madras.

The outlay on military works connected with sanitation in the Bombay Presidency during 1888 was Rs. 7,34,785 as compared with Rs. 4,02,686 in the previous year. The principal expenditure was incurred in the construction of barracks for European troops at Colaba, on which Rs. 1,36,685 were spent, and at Mhow in the construction of waterworks, at a cost of Rs. 5,38,247. The drainage of the cantonment at Baroda was improved at a cost of Rs. 10,089, and a considerable amount was expended in petty sums on minor works at various places. Bombay.

India Office,
July 1890.

W. T. Ronson.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1888.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA.

(*Sir B. Simpson, M.D.*)

European Troops.

Sickness and mortality in 1888.

The general health of the European Army of India was, according to the figures in the following table, less satisfactory in 1888 than in the previous year, the admission, daily sick, and death-rates being all greater. But it must be explained that the statistics of Upper Burma are for the first time included. Otherwise, even with the Hazara and Sikkim expeditions, the health statistics of 1888 would probably have compared favourably with those of 1887.

Abstract of Statistics of European Troops in India for the last ten years 1879 *to* 1888, *and for the ten-year period* 1870–79.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870–79	577,416	1,475	60	19·34	43	62
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26†	51†
1881†	58,728	1,605	70	16·86	38	55
1882	57,269	1,445	65	12·07	33‡	45
1883	55,525	1,336	63	10·88	33	44
1884	54,996	1,513	67	12·56	32	44
1885§	56,967	1,533	71	14·55	23	37
1886§	61,015	1,514	75	15·18	21	36
1887§	63,515	1,370	70	14·20	23	37
1888‖	68,887	1,382	71	14·84	23	38

* Excluding troops serving in Afghanistan. † Including troops in Afghanistan.
‡ Calculated on the strength obtained from Annual Returns. § Excluding troops on active service in Burma.
‖ Excluding troops in Burma for the first three months of the year.

The admission and daily sick rates, although higher than those of the previous year, were not high when compared with those of other recent years. There was an increase in the ratios of admissions from cholera, small-pox, enteric fever, ague, remittent fever, heatstroke, dysentery, hepatitis, spleen diseases, and venereal diseases. Of the total sickness venereal affections and ague together contributed no less than one-half, the former 26·82 and the latter 22·89 per cent. In the last seven years 1886 is the only one that had a higher death-rate than 1888. The chief causes of increased mortality were heatstroke, respiratory diseases, small-pox, malarial fevers, alcoholism. The mortality from cholera and that from enteric fever were almost exactly the same as in the previous year. Enteric fever caused 25 per cent. of the total deaths. The invaliding ratio remaining unchanged, the total loss of the army from death and invaliding was 1 per 1,000 higher than in 1887. The chief causes of invaliding were, in order, debility, venereal diseases, mental affections, dysentery, hepatitis, tubercle of the lung, malarial affections, and palpitation.

In the Bengal Presidency the admission rate (1,398) was the lowest recorded during the past decade, and less than the average of the decennial period, 1870–79, by 124 per 1,000 of average strength. The decrease in malarial fevers, respiratory diseases, rheumatism, and some others was greater than the increase in cholera, small-pox, enteric fever, dysentery, hepatitis, venereal affections, &c. More than half of the total admissions were due to venereal diseases and ague, 26·65 per cent. to the former and 24·38 per cent. to the latter. Though the cholera death-rate (2·10) was lower than in the previous year (2·27), the total death-rate was higher. There was increased mortality from small-pox, enteric fever, heatstroke, hepatitis, respiratory diseases, and injuries. Enteric fever caused 26·8 per cent. of the total number of deaths. The invaliding ratio (20) being also increased, the total loss by death and invaliding (36 per 1,000) was 3 per 1,000 greater than in 1887. This increased loss was due to the results of service in Upper Burma and to the Hazara and Sikkim expeditions. The Hazara

expedition took place in October and November. Reduced to annuals, its general statistics are—average strength 371, daily sick-rate 18·9, admission-rate 1,177·9, and death-rate 24·26. The Sikkim expedition continued from March to December. Reduced to annuals, its general statistics are—average strength 309, daily sick-rate 38·8, admission-rate 1012·9, and death-rate 22·65.

The rise in the admission-rate of troops in the Madras Presidency from 1,250 to 1,341 per 1,000, cholera death-rate from 0·60 to 2·83, and total death-rate from 12·96 to 15·55, is due to the inclusion of the Upper Burma statistics. Increased admission took place from cholera, small-pox, malarial fevers, and diarrhœa; whereas most of the other chief diseases gave rise to fewer admissions than in the previous year. Of the total admissions, venereal disease contributed 28·05, ague 17·35 per cent. There was increased mortality from cholera, small-pox, malarial fevers, heatstroke, dysentery, diarrhœa, and injuries. Of the total mortality, 18 per cent. was from cholera, 13 per cent. from hepatitis, 12 per cent. from remittent fever, and over 14 per cent. from enteric fever. The total loss by death and invaliding (43 per 1,000) was 1 per 1,000 less than in 1887, the reduction being due to diminished invaliding.

In the Bombay Presidency the admission-rate (1,372), though 80 per 1,000 higher than that of 1887, was low as compared with the ratios of most of the years since 1879. The daily sick-rate was the same as in 1887 (67), but 10 per 1,000 higher than the average of the decennial period, 1870–79. Of the total admissions 26·03 per cent. were from venereal diseases and 23·85 per cent. from ague. The considerable fall in the death-rate, from 13·23 in 1887 to 11·70, was due to the diminished cholera mortality (from 2·50 in 1887 to 0·59); for the death-rate from diseases other than cholera was slightly increased. There was lessened mortality from cholera, malarial fevers, heatstroke, dysentery, respiratory diseases, and phthisis; but increased mortality from enteric fever, hepatitis, and some others. No less than 34·5 per cent. of the total mortality was due to enteric fever. The invaliding rate (25 per 1,000) was also reduced by 3 per 1,000; so that the total loss of the Bombay army (37 per 1,000) was 4 per 1,000 less than in the previous year.

The vital statistics of the troops serving in the Quetta district are incorporated in those of the Bengal Presidency; but, as the command is both important and comparatively new, they are discussed also here separately. Though the admission-rate was low (1,140) yet the daily sick and death-rates considerably increased (from 52 and 11·08 per 1,000 respectively to 59 and 13·50). This means an increase of serious cases without increased general sickness. Accordingly the returns show an increase of enteric fever, hepatitis, and respiratory diseases. Of the total admissions, 19·66 per cent. were due to ague, 16·86 per cent. to venereal diseases, and 11·92 per cent. to respiratory diseases. There were in all 30 deaths, of which 40 per cent. were contributed by enteric fever, 20 per cent. by respiratory diseases, and 10 per cent. by abscess of the liver. The invaliding ratio was also increased from 8 to 22 per 1,000. Nearly 35 per cent. of the invaliding was on account of circulatory diseases—chiefly varix and palpitation. The troops of the Quetta district enjoyed during 1888 a total immunity from cholera.

The chief causes of admission into hospital in the three presidencies are shown in the following table:—

Admitted per 1,000 *of strength.*

Bengal.	1888.	1887.	1870–79.	Madras.	1888.	1887.	1870–79.	Bombay.	1888.	1887.	1870–79.
1. Malarial fevers*	427	450	607	1. Venereal diseases	376	400	198	1. Malarial fevers*	426	373	660
2. Venereal diseases	373	356	209	2. Malarial fevers*	303	204	266	2. Venereal diseases	357	337	191
3. Injuries	117	121	91	3. Injuries	118	124	101	3. Injuries	108	112	95
4. Respiratory diseases	37	37	63	4. Dysentery	56	62	77	4. Diarrhœa	35	42	61
5. Rheumatism and neuralgia.	36	38	62	5. Diarrhœa	42	38	65	5. Rheumatism and neuralgia.	27	33	49
6. Diarrhœa	34	43	62	6. Hepatitis	33	37	67	6. Dysentery	21	22	28
7. Tonsillitis and sore-throat.	27	30	21	7. Rheumatism and neuralgia.	31	31	46	7. Respiratory diseases	20	24	45
8. Dysentery	26	24	33	8. Respiratory diseases	22	26	44	8. Hepatitis	20	18	41
9. Hepatitis	24	23	47	9. Tonsillitis and sore-throat.	17	21	13	9. Tonsillitis and sore-throat.	17	22	19
10. Enteric Fever	16	13	5	10. Alcoholism	15	16	5	10. Eye diseases	15	19	21
Total from all causes	1,398	1,426	1,522	Total from all causes	1,341	1,250	1,764	Total from all causes	1,372	1,292	1,533

* Including simple continued fever.

Malarial and sun fevers, it will be seen, caused a large proportion of the sickness in all three presidencies. In Bengal the ratio was below that of the previous year and

that of the decennial period, while in the case of the other presidencies the ratios were higher than the corresponding ratios of the previous year and of the decennial period. In Madras, as usual, venereal diseases head the list; and, were simple continued fever excluded, they would do so in the other presidencies also. In Madras only was the ratio less than that of the previous year; but in all it was greater than that of the decennial period. In Bengal the increase over 1887 was 17, in Bombay 20, and in Madras the decrease was 24 per 1,000. As already noticed above, about a quarter of the total sickness of the troops in India is caused by venereal disease, and about another quarter by malaria. Respiratory diseases were less prevalent in all three presidencies. Dysentery was increased in Bengal only, and hepatitis in Bengal and Bombay.

The chief causes of death in the European armies of the three presidencies are shown in the following table:—

Deaths from	Bengal.			Deaths from	Madras.			Deaths from	Bombay.		
	1888.	1887.	1870-79.		1888.	1887.	1870-79.		1888.	1887.	1870-79.
Enteric fever	4·15	4·09	2·28	Cholera	2·83	·60	1·68	Enteric fever	4·04	3·40	1·75
Cholera	2·10	2·27	4·18	Enteric fever	2·26	2·98	1·42	Heatstroke and apoplexy	1·01	1·07	1·59
Hepatitis	1·47	1·31	2·04	Hepatitis	2·05	3·16	3·16	Hepatitis	·84	·80	1·71
Apoplexy and heatstroke	1·19	·91	1·53	Remittent fever	1·84	·43	·62	Dysentery	·76	·80	·98
Respiratory diseases	1·03	·76	1·25	Dysentery	1·06	·43	1·42	Cholera	·59	2·50	1·53
Total from all causes	15·47	14·83	21·00	Total from all causes	15·55	12·96	17·69	Total from all causes	11·70	13·23	15·27

Enteric fever was the chief cause of mortality in the Bengal and Bombay Presidencies, and next to cholera in the Madras Presidency. Out of the 40 deaths from cholera in the Madras army, 39, or 97·5 per cent., occurred in Burma; so that in the Madras Presidency proper enteric fever was the chief cause of death. The death-ratio per 1,000 from enteric fever increased in Bengal and Bombay, and decreased in Madras. Of the total number of deaths, enteric fever contributed 26·8 per cent. in Bengal, 14·5 in Madras, and 34·5 in Bombay. The excess of the ratios over those of the decennial period is more due to change of fashion in diagnosis than to actual increase of the disease, though that may have contributed also. The large number of deaths from remittent fever returned by the Madras army occurred principally (24 out of 26) in Upper Burma. There was a marked improvement in the cholera mortality of Bombay, and a slighter in that of Bengal. The death-rate from hepatitis of the Madras Presidency was, as usual, notably above that of the others. Of the total loss by death from all causes, hepatitis gave rise to 9·5 per cent. in Bengal, to 13·2 in Madras, and to 7·2 in Bombay. Owing to the climate of the Punjab and of the Quetta district, respiratory diseases stand much higher in the list of death-causes in the Bengal Presidency than in the others. The rise of the dysentery ratio in the Madras army is, at least principally, due to the inclusion of the Upper Burma statistics.

The following statement shows the admission and death-rates for a series of years in the several geographical groups of stations occupied by the European army of Bengal:—

Period.	Ratio per 1,000 of strength.															
	1 Bengal proper.		2 Gangetic Provinces and Oudh.		3 Meerut and Rohilkund.		4 Agra and Central India.		5 Punjab.		6 Quetta District.		7 Hill Stations.		Bengal Presidency.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860-69	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·48	1,741	25·24	—	—	1,069	14·78	1,755	29·98
1870-79	1,311	14·43	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	—	—	1,044	12·23	1,522	21·00
1880*	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	—	—	1,253	20·75	1,513	27·73
1881*	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	—	—	1,177	9·97	1,729	17·05
1882	1,187	11·19	1,699	22·61	1,613	8·86	1,891	10·51	1,796	12·12	—	—	975	8·65	1,579	13·17
1883	1,011	9·10	1,474	17·04	1,528	10·56	1,497	14·27	1,601	9·47	—	—	1,454	6·33	1,463	11·21
1884	1,195	10·07	1,381	14·72	2,028	17·01	1,874	15·53	1,992	9·75	—	—	1,201	5·91	1,662	11·68
1885	1,449	13·09	1,539	15·23	2,463	18·00	1,687	10·93	1,566	12·67	—	—	1,395	9·50	1,661	13·16
1886	1,675	15·46	1,630	17·09	1,902	16·68	1,526	15·91	1,442	16·64	2,850	19·58	1,219	10·27	1,559	15·52
1887	1,617	14·17	1,437	19·01	1,750	14·31	1,696	20·03	1,375	13·63	1,374	11·38	1,112	12·42	1,426	14·83
1888†	1,621	16·05	1,382	15·01	1,682	11·89	1,748	17·61	1,421	16·25	1,140	13·50	1,255	14·86	1,398	15·47

* Excluding troops in Afghanistan and on the march. † Excluding troops on active service in Burma for the first three months.

The admission-ratios of the first, third, fourth, and fifth groups, and the death-rates of the first, fourth, and fifth, were above the presidential ratios of the year. As compared with the figures for the decennium 1860–69, only the admission and death ratios of the Hill Stations and the admission-ratio of Meerut and Rohillkund were higher. The admission and death ratios of the first and seventh groups, and the admission-ratios only of the third and fourth, were greater than those of the decennium 1870–79. Compared with the previous year the admission and death ratios were both higher in the first, fifth, and seventh groups; the admission-ratio alone in the third and fourth groups, and the death-ratio alone in the sixth group. The highest admission and death-rates were those of Agra and Central India. But what has been said above shows that, as compared with the past, Bengal Proper and the Hill Stations are in worst case; while the Gangetic Provinces and Oudh group displays most improvement. Apart from an increase of cholera, the statistics of the Punjab were favourable. The first group had the highest admission-ratio for dysentery and hepatitis; the second for small-pox and enteric fever; the fourth for ague and diarrhœa; the fifth for cholera, and the sixth for respiratory diseases.

It has just been mentioned above that in Bengal Proper, the Punjab, the Quetta district, and the Hill Stations the death-rates were in excess of those of the previous year. In Bengal Proper the increase was chiefly in cholera, enteric fever, and remittent fever; in the Punjab in cholera, heatstroke, respiratory diseases, and hepatitis; in the Quetta district in enteric fever, respiratory diseases, and hepatitis; and in the Hill Stations in cholera, hepatitis, and respiratory diseases. Taking the total number of deaths in each group as 100, then in Bengal Proper there were 18 from enteric fever, 18 from hepatitis, and 14 from cholera; in the Gangetic Provinces 31 from enteric fever, 11 from heatstroke, and 9 from cholera; in Meerut and Rohilkund 45 from enteric fever and 15 from hepatitis; in Agra and Central India 32 from enteric fever, 11 from phthisis, and 8 from dysentery; in the Punjab 21 from cholera, 20 from enteric fever, and 10 from heatstroke; in the Quetta district 40 from enteric fever, 20 from respiratory diseases, and 10 from hepatitis, and in the Hill Stations 33 from enteric fever, 14 from cholera, and 13 from hepatitis. The highest death-rate from enteric fever (5·65) and the highest from dysentery (1·33) arose in Agra and Central India; the highest from cholera (3·35) in the Punjab; and the highest from respiratory diseases (2·70) in the Quetta district.

Of the large garrisons with a strength of over 1,000, the following returned a death-rate over 15 per 1,000:—

	Average Strength.	Mortality per 1,000 of average Strength.
Allahabad - - -	1,036	17·37
Rawalpindi - - -	2,708	32·50
Murree Hills - - -	1,600	19·38
Peshawar - - - -	1,718	17·46

The highest ratios were those of Murree Depôt (103·05 from a strength of 262), Chunar (52·63 from 76), Landour Depôt (42·25 from 142), Jhansi (34·98 from 486), and the lowest, those of Barrackpore (2·88 from 347), Cherat (3·73 from 536), Fyzabad (4·52 from 885), and Bareilly (7·24 from 1,381).

During the year under review, 14,980 men of the Bengal army, or 33·14 per cent. of strength, were located in the hills. The health of the troops was not so good as in the previous year, as is shown by the raised admission, daily sick, and death rates. The rise in the death-rate was due to cholera, hepatitis, and respiratory diseases chiefly; and the cholera was almost entirely confined to the Murree Hills.

The health-statistics of the troops of the Rajputana, Malwa, Sind, and Aden group were, on the whole, favourable; whereas the admission-rate (1,468) was higher, yet the daily sick (65·8) and death rates (13·34) were considerably lower. The most important among the diseases causing increased admission were small-pox, ague; and alcoholism. The greatest reduction of mortality was in cholera. The largest stations in this group are Mhow (strength 1,406), Kurrachee (1,010), and Aden (824). At all three the daily sick and admission rates were increased, while the death-rates were diminished. The chief causes of increased admission at Mhow were fevers, venereal diseases, hepatitis, and respiratory diseases; while there was a great decrease in deaths from enteric fever and cholera. At Kurrachee the chief increase in admissions was in fevers and hepatitis; the chief decrease of mortality in enteric fever. Fevers,

venereal diseases, respiratory diseases, and diarrhœa were the principal heads of excess admission at Aden; heatstroke the principal head of lessened death. There continued to be an absence of death from enteric fever at Aden.

Though the admission (1,232) and daily sick rates (71·2) of the troops in the Deccan and Nagpur were increased, the death-rate (9·19) was diminished by 1·69 per 1,000. The increase of sickness was chiefly in small-pox, ague, and venereal disease; while the decreased mortality was principally in cholera, malarial fevers, hepatitis, and some others. There was increased mortality from small-pox and enteric fever. The largest garrisons of the group are Poona (strength 2,102), Secunderabad (2,772), Belgaum (1,149). At Poona the sickness was greater than in the previous year, chiefly from fevers; and the mortality was also higher, chiefly from cholera and enteric fever. At Secunderabad the sickness and mortality were both lower than in 1887. At Belgaum also, where the strength was considerably higher than in the previous year, both sickness and mortality were also diminished.

In Southern India also there was, with an increase of the admission (1,323) and daily sick rates (78·7), a decided lowering of the death-rate (from 11·36 to 9·00). The increase of sickness was chiefly in ague, small-pox, diarrhœa, and respiratory diseases. The diminished mortality was mainly in enteric fever, hepatitis, and respiratory diseases. The largest garrisons are those of Bangalore (2,228) and Bellary (810). Bangalore had very greatly increased sickness with diminished mortality. The daily sick-rate was increased by 29·5 per 1,000, the admission-rate by 356·1, while the death-rate was 1·07 per 1,000 less. The diseases which gave admissions greatly in excess of the previous year were diarrhœa, hepatitis, rheumatism, and neuralgia, venereal diseases, and respiratory diseases. At Bellary all three ratios were higher than in 1887. The chief increase of sickness was in malarial fevers, rheumatism, and respiratory diseases, there having been actually a great decrease in venereal diseases.

The statistics of Lower Burma for the year and those of Upper Burma for the last nine months of the year are combined. They cannot, therefore, be directly compared with those of former years. The admission-rate was 1,680 per 1,000, the daily sick-rate 86·7, and the death-rate 32·50. Lower Burma comprises four stations: Rangoon, Toungoo, Thayetmyo, and Port Blair. The admission-rate of this group was 1,102·1 against 1,467·7 in the previous year, and the death-rate 13·41 against 11·61. Rangoon with a lower admission-rate had a higher daily sick-rate and a slightly higher death-rate. The last was due to cholera. There was a decrease in admission from nearly all the principal diseases. Toungoo had lower admission and daily sick rates, with a death-rate nearly three times that of 1887; this latter, however, being the combined result of a lower average strength with the occurrence of five deaths instead of two. Hepatitis caused two deaths out of the five; the others were from enteric fever, heatstroke, and dysentery. All the ratios at Thayetmyo were lower than in the previous year. Port Blair had increased admission and daily sick rates with a diminished death-rate. The greatest increase of admission was under the head of malarial and simple continued fevers. Those stations of Upper Burma which were occupied for the whole nine months and which had a strength of over 100 may be now considered. They are Meiktila, Mandalay, Shwebo, Bhamo, Bernardmyo, and Myingyan. The highest daily sick-rate was 131·2 at Myingyan, and the lowest 48·8 at Bernardmyo. The highest admission-rate was 3,649·4 at Bhamo, and the lowest 1,195·1 at Bernardmyo. The highest death-rate was 81·45 (including 31·67 cholera) at Myingyan, and the lowest 9·71 at Shwebo. Myingyan had the highest admission-rate from cholera, Bhamo from fevers, Mandalay from dysentery, Meiktila from hepatitis, and Bernardmyo from respiratory diseases. The chief causes of death in these Upper Burma stations were cholera and remittent fever. Thus, of the 25 deaths at Mandalay 9 were from cholera, 6 from remittent fever, 4 from hepatitis, and 3 from dysentery; of the 16 at Bhamo 8 from remittent fever and 2 from cholera; of the 18 at Myingyan 7 from cholera and 4 from remittent fever. Only 3 deaths from enteric fever were reported from Upper Burma, 1 at Bhamo and 2 at Myingyan.

Both the admission and death-rates (1,224 and 4·10 per 1,000 respectively) for the Hill Stations of Madras and Bombay were very much reduced, although the average strength remained much the same. Malarial fevers, dysentery, respiratory diseases, and venereal affections were among the diseases which gave rise to fewer admissions. The only diseases which caused mortality were hepatitis (3 deaths) and spleen affections (1 death). There was not a single death from any form of fever, although the

following fever-admissions were returned—enteric 5, ague 195, remittent 5, simple continued 26, other fevers 2.

Cholera.

Cholera prevailed to a greater extent in the army of India than in 1887. There were 207 admissions against 183, and 137 against 127 deaths. But the ratios were almost exactly the same. The permillage of admissions to strength was 3·0, and of deaths 1·99, and the percentage of deaths to cases 63·77. The corresponding figures of the decennium 1870–79 were 4·7, 3·22, and 69·11.

The ratios of morbidity, mortality, and fatality in the Bengal army were respectively 3·5, 2·10, and 60·81, against 3·3, 2·27, and 67·75 in 1887 and against 5·9, 4·18, and 70·26 in the decennium. The incidence of the disease in the year was 9 cases before July, 127 cases in July, August, and September, and 12 cases after September. The maximum was reached in August. The Quetta district and Agra and Central India were quite free from cholera. The stations most severely visited were Rawalpindi (57 cases with 36 deaths), Murree (28 cases with 16 deaths), and the Murree hills (18 cases with 14 deaths).

Of the 49 seizures with 40 deaths which occurred in the Madras army only 2 cases with 1 death fell to the lot of the presidency proper; all the rest happened in Burma. Mandalay had 15 cases with 9 deaths, and Myingyan 12 cases with 7 deaths.

The cholera mortality of the Bombay army fell to 0·59 from 2·50 in the previous year. There were in all 10 cases with 7 deaths, of which 7 cases with 5 deaths occurred at Poona.

Small-pox.

Small-pox was more prevalent. There were 111 admissions (1·6 per 1,000) and 10 deaths (0·15 per 1,000) against 43 (0·6 per 1,000) and 2 (0·03 per 1,000) in 1887. In the Bengal Presidency Lucknow had 32 cases with 5 deaths, Mooltan 10 cases with 1 death, Umballa 1 case ending fatally, and Jubbulpore 2 cases with 1 death. Secunderabad in the Madras Presidency had 5 cases with 1 death; and Mhow in the Bombay Presidency 8 cases with 1 death. In the other stations where small-pox occurred there were no deaths.

Fevers.

Ague gave rise to about 23 per cent. of the admissions from all causes in the army of India. The admission-ratio (316) was 16 per 1,000 higher than in the previous year. In Bengal there was a lower admission with a higher death-rate. The raised admission and death ratios of Madras are due to the inclusion of the statistics of Upper Burma. In Bombay, although there was an increased prevalence of ague, there was no mortality, all the fatal fevers being returned either as remittent or as enteric.

That the ratios for remittent and simple continued fevers did not decline in the Madras Presidency as they did in the other presidencies is due to the inclusion in the former of the statistics of Upper Burma, where occurred a large number of cases of remittent fever. The ratio for the army of India as a whole sank from 91 to 85 per 1,000. Many of the cases formerly included under this head are now returned as enteric fever.

In the beginning of 1889 the Government of India appointed a committee, having the following composition—

BENJAMIN SIMPSON, M.D., K.C.I.E., Surgeon-General, and Sanitary Commissioner with the Government of India,

W. A. THOMSON, M.B., Surgeon-General, H.M.'s Forces in Bengal,

J. RICHARDSON, M.B., Deputy Surgeon-General, and Sanitary Commissioner, Central Provinces,

D. D. CUNNINGHAM, M.B., Professor of Physiology, Medical College, Calcutta,

to inquire into alleged increase of enteric fever in the army of India. The following quotations give the main results arrived at by the committee. These on the whole support the views so long advanced in this report. The statistics on which the committee's opinions are founded are to be seen in their printed report:—

"The main facts recorded regarding the prevalence of the group of remittent and continued fevers in the Bengal Presidency during recent years may be briefly stated as follows:—

(1) A great diminution in the prevalence of the group has occurred, the eleven years' period, 1877 to 1887, showing a decrease in average admission-rate of 28 per cent. when compared with the previous eleven years.

(2) During the same time an increase of over 50 per cent. has occurred in the prevalence of enteric fever.

(3) The prevalence of the group and of enteric fever alone exhibits periodic fluctuations manifesting themselves over widely extended areas and due to the incidence of widely-diffused factors, the principle of which appear to be variations in the numbers of a specially susceptible population and cyclical variations in climatic conditions.

The principal facts recorded regarding mortality from the group of remittent and continued fevers are as follow :—

1. There has been an increase in the average annual death-rate in the nine years, 1880 to 1888, as compared with the previous nine years, amounting to 1·01 per 1,000 of average strength.
2. During the same period there has been a very great increase in the rate of mortality ascribed to enteric fever—70 per cent.
3. There has been a simultaneous decrease of 40 per cent. in the mortality ascribed to remittent and simple continued fevers.
4. The death-rate from enteric fever has diminished greatly in comparison to the admission-rate, indicating an apparent alteration in the character of the disease.

The entire series of phenomena regarding the prevalence of, and mortality from, these fevers as a group and as individual species admit of various interpretations. If we simply look to the figures, they indicate a general decrease in prevalence of, and slightly increased mortality from the group, very greatly diminished prevalence of remittent and simple continued fevers, and greatly increased prevalence and diminished severity of enteric fever. The question, however, arises, how far do the figures actually represent changes in the prevalence and type of disease, and how far do they not correspond to a mere change in medical opinion and nomenclature? There can, of course, be no debate in regard to such matters as the increase in mortality and decrease in prevalence of the group of fevers, but there are considerable grounds for suspecting that the other phenomena are, to some extent at all events, of subjective origin. The figures regarding the admission and death-rates furnished by the individual fevers during the past decade are hardly explicable, save as the result of a mere change in nomenclature, of a mere redistribution of a total into parts of different proportions. It is, moreover, a mere matter of medical history that until a recent period, the existence of enteric fever in India was not recognised, and that more and more attention has been directed to its presence and prevalence in the country of late years.

The natural result has followed, and the number of cases of the disease recognised and recorded has steadily increased. The great increase in the prevalence of the disease indicated by the figures of admission-rates cannot, therefore, be taken as corresponding to any actual increase in the intensity of the local conditions giving rise to the disease, but, in great degree, to mere improved or altered diagnosis. There can be no doubt that improved diagnosis led to the recognition of the existence of enteric fever in India; but in respect to the question of prevalence of the disease, it is not so clear we have to deal with improvement alone. That the specific enteric fever of Europe exists in India no one would at the present time think of denying, but, at the same time there appears to be some danger that its prevalence may be over-estimated, due to the prevalent tendency to assume, on insufficient grounds, that other forms of fever of the type ordinarily described as remittent or simple continued fevers hardly exist. There is a prevalent tendency to assume that the diagnosis of a case of fever as of specific enteric nature may be safely founded on a mere inspection of a temperature chart, and even that unrecorded prevalence of the disease may be detected by means of the study of death-rates, any considerable excess in the percentage of deaths to cases of enteric fever over the standard European death-rate of 17 per cent. being regarded as a sufficient indication of defective diagnosis and record of cases. Curiously enough, those who advocate this method of diagnosis do not seem to appreciate its double-edged nature, and do not propose to apply it to cases in which the recorded death-rate falls short of, in place of exceeding, the European standard. It is, according to them, safe to assume that a record of mortality, like that furnished by Chaubuttia in 1886, of 22 per cent. of deaths to admissions indicates defective record of cases of enteric fever, but at the same time, that records, like that of Ranikhet in the same year, of 8·3 per cent., or that of Lucknow in 1888, of 12·7 per cent., may be accepted as insusceptible of criticism.

The great apparent increase in the amount of enteric fever among the troops of late years is not, then, to be attributed to actual increase or even entirely to improved diagnosis, but may very possibly be partly due to defective diagnosis connected with mere change in prevalent opinion. So far as the treatment of cases of fever alone is concerned, it is a matter of little moment whether this actually be the case or not, for to regard every case of remittent and continued fever as probably of truly enteric nature, and to treat it accordingly, would probably do good rather than harm. This, however, is no longer the case when we come to consider questions relating to the prevention of disease. To regard all remittent and continued fevers as of specific enteric nature on insufficient evidence must inevitably lead to confusion and retard the prevention of disease by limiting attention to the provision of preventive measures calculated to secure exemption from one form of disease alone. There are good reasons for regarding fæcal contamination of a locality as the determinant of the occurrence of specific enteric fever in it, but it by no means follows that it is the essential cause of the occurrence of all forms of fever of remittent and continued type prevailing in this country, so that, even could all fæcal contamination of localities be absolutely prevented, the occurrence of cases of fever would not necessarily cease. There is, no doubt, still need for increased precautions to secure the effectual prevention of fæcal contamination of our large military stations, but it is very undesirable that attempts at improvement and attention to sanitation should be limited by insufficiently-founded theories. By all means let us attempt to secure that no materials liable to fæcal contamination should come in contact with the troops, but do not let our attention be solely limited to this due to the influence of mere prevalent beliefs.

One question remains to be considered relating to the slight increase in the average death-rate from the group of remittent and continued fevers of late years. This increase is of special importance, as it may appear to indicate the occurrence of positive deterioration in conditions of locality, or, in other words, of deterioration in local sanitation during the period under observation. There is, however, evidence to show that it would be a mistake to regard it as doing so, and that the phenomenon is capable of another explanation. This evidence consists, 1st, in the data regarding the prevalence of the group of fevers for the period, and, 2nd, in those regarding the coincident change in the nature of the military population. It is impossible to imagine that, under any general deterioration of sanitation, such marked decrease in the prevalence of the fevers as a group as has actually manifested itself should have occurred. On the other hand, the great increase in the bulk of the population specially liable to the severer forms of fever, whether these be all of truly enteric fever or not, which has taken place during the period, may be regarded as telling powerfully enough in favour of increased mortality to account for the increase in the death-rate of the period quite apart from any coincident deterioration in local sanitary conditions. The increased mortality, however, indicates the necessity of positive improvement of local conditions if the death-rate from the group of fevers is to be retained, even at the same level as it formerly had, under the influence of changes in the nature of the population.

The phenomena of fever manifesting themselves during December 1888 and January and February 1889 in Meerut and Lucknow appear, at first sight, very different; but, on closer examination, it appears that, to a great extent, the difference is merely one of nomenclature. The evidence of this is contained in the following table:—

Prevalence of Remittent and Continued Fevers in Lucknow and Meerut, December 1888 *to February* 1889.

		Lucknow.	Meerut.
	ADMISSIONS.		
December 1888	Enteric fever	20	4
	Remittent fever	—	—
	Simple continued fever	—	25
January 1889	Enteric fever	23	7
	Remittent fever	—	—
	Simple continued fever	—	8
February 1889	Enteric fever	7	2
	Remittent fever	—	—
	Simple continued fever	—	5
	Total cases	50	51
	DEATHS.		
December		3	1
January		—	3
February		3	1
	Total deaths	6	5
Percentage of Deaths to cases		12·0	9·8
Percentage of cases among officers to total cases		24·0	15·6
Percentage of cases of enteric fever among officers to total cases of the disease		24·0	61·0

Taking these figures as they stand, it can hardly be doubted that, to a very great degree, they represent differences in local opinion rather than differences in local fact. In so far as the practical outcome of the period under consideration is concerned, the results in Meerut and Lucknow are essentially the same, there having been an almost complete identity both in the prevalence of, and the mortality from, fever among two bodies of troops of equal strength— the average weekly strength in December and January having been 3,895 in Meerut and 4,002 in Lucknow.

We have, then, two bodies of troops of almost identical numbers and under fairly parallel conditions, during one and the same period, yielding practically identical results as regards prevalence of, and mortality from, fever, and the fact that in one station the fever is recorded as of one species only, and, in the other, as belonging to two distinct species, can only be regarded as mainly due to a difference of opinion. There are no means of deciding definitely in favour of one opinion rather than the other, but it appears not improbable that we have to deal with error in both cases alike, and that, whilst there has been a tendency in Lucknow to record cases as of truly enteric nature on insufficient evidence, there has, in Meerut, been an error on the opposite direction, and that cases of enteric fever have escaped record as such.

We are in Meerut again encountered by the curious phenomenon of relative excess of prevalence of enteric fever among officers as compared with men. The cases among officers constituted 15 per cent. of all cases of fever occurring during the period, and 61 per cent. of those recorded as of enteric

nature. Here again we have to inquire whether this excess be due to excessive liability to exposure to access of the specific cause of disease, or to excessive predisposition to succumb to it on access. Again, as in the case of Lucknow, it is difficult to see why officers should be specially liable to exposure to the specific cause of enteric fever under the influence of the conditions of camp-life, and here again it appears that the excess of prevalence among them must be regarded as the result of excessive predisposition. At the same time it must be borne in mind that, so long as the present uncertainty in the discrimination of various forms of fevers prevails—so long as it is not absolutely certain that all cases ascribed to enteric fever are really of truly enteric nature—of a nature identical with the specific enteric fever of Europe—we have no right to regard them as invariably necessarily connected solely with fæcal contamination of locality. There is a growing mass of evidence on record showing that cases of fever occur in India which present many phenomena closely resembling those of specific enteric fever, but characterised by ulcerative intestinal lesions differing from those of that disease, and therefore, presumably due to a distinct agency. Such cases will naturally tend to show enteric, or in other words, intestinal symptons, but this does not render them of the nature of true specific enteric fever. Moreover, there are certain grounds for going even further and maintaining that it is quite possible that cases of fever may exist showing intestinal lesions identical, in general aspect, with those of true enteric fever, and yet not due to the same specific cause as that connected with their presence in the latter disease. It is quite true that among the forms of continued fevers occurring in Europe, specific enteric fever is the only one characterised by the presence of intestinal lesions of a peculiar type, but it by no means necessarily follows that this should hold good for all the forms of continued fever occurring elsewhere. So long as Peyer's patches and the solitary follicles of the intestinal mucous membrane continued to be structures the nature of which was not understood, it was very possible to regard the changes occurring in them in cases of true enteric fever as necessarily of a very peculiar and specific character. Now, however, when we know that they are merely aggregates of lymphatic tissue and remember what the nature of that tissue is, it is no longer possible to do so. The structural changes occurring in the patches and follicles must surely be regarded merely as the result of the retention of irritant bodies by the filters which the localised masses of lymphatic tissue represent, and they present no special features, apart from the presence of bodies of peculiar nature playing the part of irritants, which might not readily arise as the result of irritation from various causes. This being so, it becomes doubly necessary to exercise caution in determining the nature of cases, even where intestinal lesions closely resembling those of specific enteric fever are present. The presence of the characteristic intestinal lesions is diagnostic of the specifically enteric nature of cases of fever in Europe, and the same may very probably hold good for cases occurring elsewhere, but it is well to bear in mind that the question remains an open one. No hasty diagnosis of the nature of a case founded on the presence of one or other of the characteristic symptoms of enteric fever, or even on the presence of the so-called "anatomical sign" alone, is satisfactorily conclusive, as even the anatomical sign is one merely definitely determinative in connexion with fevers within certain geographical limits. In this connexion it is of great importance that every possible aid to diagnosis should be called into play, and one which may possibly prove of great service may be looked for in bacteriological research, for if the peculiar organism whose presence in the tissues characterises the specific enteric fever of Europe be found in the tissues of cases of fever of enteric type in this country, there can hardly be any further room for discussion in regard to the identity of the disease in both areas.*

In the meantime, and under existing conditions, there can be no doubt that there is great need for the exercise of extreme caution in diagnosing cases of fever occurring in India as of specific enteric nature. To do so hastily, on insufficient evidence, and merely because of the natural tendency to yield to prevailing opinion, is to be deprecated as only tending to retard the advance of science and of practical measures directed towards the prevention of disease. All the cases recorded at Lucknow and Meerut as cases of true specific enteric fever during December 1888 and January 1889 no doubt presented features resembling, in greater or less degree, those of the specific enteric fever of Europe, but, at the same time, the anomalous phenomenon of excessive prevalence among officers occurring in both localities—that is, the phenomenon of excessive prevalence of the disease among a body of men who cannot be regarded as specially exposed to the influence of the conditions specially favouring exposure to the action of what is accepted as the essential cause of the disease—cannot but excite suspicion in regard to the absolute correctness of diagnosis. It may, perhaps, be the case that the anomaly is to be accounted for merely as the result of the action of special predisposition, but it may also well be that the excessive prevalence is due to the existence of cases of disease of a different nature and origin than that of true enteric fever.

In conclusion, it appears that there is no evidence to show that the recent prevalence of fever in Lucknow and Meerut was due to any special defects in the sanitary arrangements in these stations during the period of prevalence, but that in order to avoid the probability of the recurrence of excessive prevalence of fever of the type which is now currently regarded as of truly enteric nature, additional efforts should be made to improve the sanitary conditions of the troops, both under normal circumstances and very specially under the exceptional conditions prevailing in connexion with camps of exercise and instruction. This necessity for improvement beyond the present standard is apparently due to the fact that the recent change in the nature of the military population in respect to age and the conditions of camp-life appear alike to favour the occurrence of the severer types of remittent and continued fevers as the result of increased predisposition to the action of their specific causes."

* In regard to this point the evidence as yet is of a negative character, specimens of the tissue of the spleen and mesenteric glands obtained from cases of the enteric fever of Lucknow having, up to the present time, failed to show any indications of the presence of the so-called typhoid bacillus.

The following table shows the admission and death rates for enteric and for intermittent, remittent, and simple continued fevers for a series of years :—

Period.	Bengal.						Madras.						Bombay.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric fever.	Ague, remittent, and simple continued fevers.	Total.	Enteric fever.	Ague, remittent, and simple continued fevers.	Total.	Enteric fever.	Ague, remittent, and simple continued fevers.	Total.	Enteric fever.	Ague, remittent, and simple continued fevers.	Total.	Enteric fever.	Ague, remittent, and simple continued fevers.	Total.	Enteric fever.	Ague, remittent, and simple continued fevers.	Total.
1870-79*	5·3	607·3	612·6	2·28	1·74	4·02	3·9	266·5	270·4	1·42	0·62	2·04	3·1	659·9	663·0	1·75	1·14	2·89
1880†	8·7	809·6	818·3	3·07	2·66	5·73	2·6	450·1	452·7	1·36	0·39	1·75	9·5	1,117·3	1,126·8	5·76	3·23	8·99
1881†	6·3	763·9	770·2	2·62	0·81	3·43	0·9	278·7	279·6	0·58	0·19	0·77	4·2	840·6	844·8	2·83	0·91	3·74
1882	7·3	600·0	667·3	2·90	0·77	3·67	4·0	171·5	175·5	2·09	0·27	2·36	5·1	558·5	563·6	1·90	0·81	2·71
1883	8·1	486·4	494·5	2·52	0·44	2·96	8·6	128·4	137·0	2·86	0·28	3·14	5·7	436·4	442·1	1·55	0·73	2·28
1884	12·6	682·8	695·4	3·31	0·36	3·67	11·4	166·0	177·4	1·67	—	1·67	9·1	504·4	513·5	2·05	2·14	4·19
1885	14·0	611·0	625·0	4·05	0·60	4·65	6·4	149·4	155·8	2·19	0·19	2·38	7·3	577·5	584·8	2·54	1·49	4·03
1886	21·6	490·5	512·1	5·70	0·99	6·69	11·9	259·8	271·7	3·85	0·89	4·74	12·3	472·2	484·5	4·16	0·27	4·43
1887	13·4	449·7	463·1	4·09	0·76	4·85	11·5	203·6	215·1	2·98	0·51	3·49	11·3	372·6	383·9	3·40	0·90	4·30
1888‡	16·2	427·1	443·3	4·15	0·34	4·49	7·4	302·8	310·2	2·26	2·19	4·45	11·6	425·5	437·1	4·04	0·34	4·38

* Including troops on active service and on the march. † Excluding troops in Afghanistan.
‡ Excluding troops on active service in Burma for the first three months.

The admission and death ratios for total fevers were diminished in the Bengal, increased in the other presidencies. In Madras this was, at least in great part, owing to the large number of malarial fevers in Upper Burma. The admission and death ratios for enteric fever were increased in Bengal and Bombay, diminished in Madras. The other fevers were less prevalent in Bengal, more prevalent in Madras and Bombay, than in the previous year. In all cases the Bengal ratios were higher than those of Bombay, and those of Bombay higher than those of Madras. All three presidencies had death-ratios higher than the decennial averages; while only in Madras was the admission-ratio higher than that of the decennium.

The following table is introduced to show the fluctuations in the death-rates from enteric and from the other fevers during the years 1873–88 :—

Presidencies.	Fevers.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.*	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Bengal	Intermittent, remittent, and simple continued.	1·39	1·10	1·18	0·71	0·66	1·56	2·63*	2·66*	0·81	0·77	0·44	0·36	0·60	0·99	0·76	0·34
	Enteric	1·53	2·01	1·59	1·75	1·55	4·69	3·86*	3·07*	2·62	2·90	2·52	3·31	4·05	5·70	4·09	4·15
	Total	2·92	3·11	2·77	2·46	2·21	6·25	6·49*	5·73*	3·43	3·67	2·96	3·67	4·65	6·69	4·85	4·49
Madras	Intermittent, remittent, and simple continued.	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19	0·27	0·28	—	0·19	0·89	0·51	2·19
	Enteric	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58	2·09	2·86	1·67	2·19	3·85	2·98	2·26
	Total	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77	2·36	3·14	1·67	2·38	4·74	3·49	4·45
Bombay	Intermittent, remittent, and simple continued.	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91	0·81	0·73	2·14	1·49	0·27	0·90	0·34
	Enteric	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83	1·90	1·55	2·05	2·54	4·16	3·40	4·04
	Total	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74	2·71	2·28	4·19	4·03	4·43	4·30	4·38

* Excluding troops in Afghanistan.

The next shows similar statistics in a more compressed form :—

	During 1870–79.			During 1880–85.			During 1887.			During 1888.		
	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.
Army of India	2·03	1·42	3·45	2·89	1·02	3·91	3·76	·74	4·50	3·75	0·73	4·48
„ Bengal	2·28	1·74	4·02	3·18	1·08	4·26	4·09	·76	4·85	4·15	0·34	4·49
„ Madras	1·42	0·62	2·04	1·79	0·22	2·01	2·98	·51	3·49	2·26	2·19	4·45
Bombay	1·75	1·14	2·89	2·77	1·55	4·32	3·40	·90	4·30	4·04	0·34	4·38

* Intermittent, remittent, and simple continued fevers.

Both tables display the increase of enteric fever-mortality in recent years, the simultaneous decrease in the mortality from other fevers, and the increase of the total mortality from fevers in the years of active service in Afghanistan (1878–80) and Burma (1885 onwards). But, apart from the influence of active service, there appears to have been, of late years, an increase of mortality from fevers. This is usually, and probably with right, ascribed to a greater predisposition on the part of the army on account of the youthfulness and recent arrival of so many of its members.

The relationship between enteric fever and age is exhibited in the following Table:—

Statement showing the Death-ratios of the European Army from Enteric Fever at different Ages, together with Ratios of Liability to it, from 1879 *to* 1888.

Year.	Mortality from Enteric Fever and Ratio of Liability to it at Different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1879	6·17	54·1	2·73	23·9	1·78	15·6
1880	6·25	56·26	3·15	28·35	1·09	9·81
1881	4·56	59·84	1·57	20·60	0·79	10·37
1882	4·32	56·18	1·55	20·16	0·78	10·14
1883	4·34	66·36	1·50	22·94	0·70	10·70
1884	4·61	62·05	1·83	24·63	—	—
1885	5·16	61·06	2·30	27·22	0·74	8·76
1886	7·44	63·05	3·08	26·10	1·02	8·65
1887	5·37	54·24	2·63	26·57	0·68	6·87
1888	5·46	61·21	2·36	26·46	0·84	9·42

The results shown do not differ materially from those of recent years, and their significance has not only been repeatedly indicated in former annual reports, but is also well known to all medical officers of Indian experience.

As with age, so with length of service in India, the disease stands in well-defined relationship. With increased service in India liability to become affected by enteric fever rapidly diminishes.

A comparison of the following tables with the foregoing supports also the opinion, expressed by many medical officers as the result of experience, that shortness of Indian service is even more powerful than unripeness of age as a predisposing cause of enteric fever:—

Statement showing the Proportion of Men who have served in India Two, Five, and Seven Years from 1871–88.

Period.	Percentage of Men to Total Strength who have served in India.			Period.	Percentage of Men to Total Strength who have served in India.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871	36·2	64·6	78·9	1880	33·4	65·4	77·2
1872	33·7	66·7	80·0	1881	38·9	70·4	81·1
1873	31·7	65·5	79·6	1882	33·1	71·9	82·9
1874	25·9	64·3	79·8	1883	32·3	74·7	85·5
1875	26·1	60·1	81·0	1884	36·2	75·0	86·2
1876	25·5	57·6	75·1	1885	36·6	73·0	86·8
1877	25·2	56·2	72·6	1886	38·8	74·7	86·8
1878	28·9	59·8	73·0	1887	35·3	72·7	86·1
1879	32·1	60·9	72·6	1888	32·4	75·8	88·7

Statement showing the Death-ratios of the European Army from Enteric Fever at different Periods of Residence in India, together with Ratios of Liability to it, for 1879–88.

Year.	Mortality from Enteric Fever, and Ratio of Liability to it at different Periods of Residence in India.					
	1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.	Deaths per 1,000.	Percentage of liability.
1879	7·99	67·2	2·18	18·3	1·24	10·4
1880	9·08	75·98	1·78	14·90	0·47	3·93
1881	4·55	60·02	2·07	27·31	0·56	7·39
1882	4·68	61·10	1·93	25·19	0·34	4·44
1883	4·98	70·34	1·55	21·89	0·55	7·77
1884	5·47	70·04	1·55	19·85	0·46	5·89
1885	6·55	68·87	1·93	20·29	0·38	4·00
1886	8·63	64·12	3·31	24·59	1·12	8·32
1887	7·13	66·57	2·37	22·13	0·82	7·66
1888	6·39	62·40	2·77	27·05	1·08	10·55

In connexion with the lessons to be learned from the foregoing the following remarks of Sir Benjamin Simpson's committee are of importance :—

"There is, of course, one general factor which will naturally serve as a determinant of fluctuations in the prevalence of enteric fever quite apart from any coincident alteration in the conditions of locality. This factor is the supply of material to be acted upon by the local conditions, in this case the supply of a population specially predisposed to enteric fever; or, in other words, the population of young soldiers and the records of prevalence of the disease afford unequivocal evidence of its action. The presence of an excessive number of young soldiers, under 25 years of age, of late years, in the Bengal Army has been accompanied by a general increase in the recorded prevalence of enteric fever; the two periods of minor prevalence of the disease during the past 18 years coincide with periods during which the number of such young soldiers was at its lowest, and the two periods of excessive prevalence with periods during which the numbers were much higher. This, however, is all that we are justified in asserting, for there is no close correspondence between the actual fluctuations in numbers of young soldiers from year to year and the coincident fluctuations in prevalence. It is true that during the last period of excessive and of absolutely maximal prevalence the absolute maxima of admissions and of numbers of young soldiers occurred in the same year, 1886, but at other times deviations, and some of them of great magnitude, have presented themselves. For example, the absolute minimum prevalence for the entire period under observation, corresponding to an admission-rate of only 2·9 per 1,000, occurred in 1872, when the number of young soldiers was, no doubt, low as compared with what it has been of late years, but still considerably higher than it was in 1876–77, when the prevalence gave rates of 4·7 and 3·7 per 1,000. The most striking deviation, however, manifests itself in connexion with the immediately succeeding period. In 1877 the prevalence of enteric fever and the numbers of young soldiers in the country had both fallen to a very low ebb. In 1878 a considerable increase to the population of young soldiers took place, and the prevalence of the disease at once rose to the maximum of that periodical fluctuation. Large increments to the number of young soldiers occurred successively in the two succeeding years, but the prevalence of enteric fever, in place of showing corresponding increase, fell rapidly and attained a relative minimum, corresponding to an admission-rate of only 6·3 in 1881, a year in which the number of young soldiers was still almost at its maximal elevation for the period. During the next two years the prevalence of enteric fever steadily rose while the numbers of young soldiers rapidly fell, and it was not until 1884 that a coincident elevation in prevalence of disease and in numbers of young soldiers manifested itself. The first period in which such coincidence occurred, 1878, was thus separated by an interval of five years from the second one, 1884. With regard to deviations presenting themselves early in the course of the entire period under observation, it must be allowed that a possible explanation of them may have existed in imperfect diagnosis at a period when the existence of enteric fever as an Indian disease had only been recently recognised. On the other hand, however, very much weight cannot be based on such an explanation when it is taken into account that periods of excessive prevalence of enteric fever coincide with periods of excessive prevalence of the fevers as a group. The deviations between the fluctuations in prevalence and in numbers of young soldiers still remain conspicuous when the prevalence which enters into the comparison is that, not of enteric fever alone, but of the group of fevers of which it forms a member. In 1878 prevalence of the group of fevers rose at once to a relative maximum coincidently with the occurrence of the first of three successive large increments in the numbers of young soldiers; it remained almost unaltered in 1879, and showed a very large decrease in 1880, coincidently with the addition of the third increment. Subsequently prevalence remained practically unaltered during 1882–83, a period in which considerable

decrease in the population of young soldiers occurred, and the absolutely minimum prevalence of 1885 occurred at a time when a great increase in numbers had occurred.

The mere bulk of a specially susceptible population present at any given time appears thus to be incapable of wholly accounting for the phenomenon of widely diffused variations in prevalence of enteric fever, or of the group of fevers within which it is included, manifesting themselves simultaneously in localities distributed over wide areas in the Bengal Presidency. It is, doubtless, an important factor in determining the occurrence, but cannot be regarded as the sole determinant of the phenomenon, which would appear to be also partially under the influence of other widely-diffused agencies, probably of climatic origin. In any case, however, it remains clear that unusual prevalence of enteric fever, or of the group of fevers to which it belongs, in any given locality at any special period is not necessarily connected with any deteriorative alterations in it of purely local origin, and, therefore, of permanent nature."

The following are remarks of Sir Benjamin Simpson's committee on the subject of seasonal prevalence :—

" Whilst there is, thus, a general correspondence in the rhythm of prevalence of all the three species of fever, it must be noted that the period of maximum prevalence of enteric fever falls in April and May, but that of remittent fever in August and September, and that of simple continued fever in September. In other words, enteric fever attains it absolute maximum prevalence during the hot weather, and remittent and simple continued fevers their absolute maximum prevalence during the latter part of the rains. Conversely, the average annual prevalence of enteric fever sinks to an absolute minimum in July, is nearly as low in October, and shows a rise in November; whereas the absolute minimum for the other two fevers occurs in December, January, and in December, January, and February. These averages, in so far as the periods of maximal prevalence go, are not misleading—that is, they are not the result of excessive prevalence in special years at otherwise exceptional periods, but correspond with the actual facts of prevalence for the majority of years included within the decade. In regard to the period of minimal annual prevalence of enteric fever, however, it must be noted that, whilst the average for July has been lower than that for any other month, the absolute minimum of any given year has only thrice occurred in July within the decade, and then only as a repetition of an equally low prevalence in January and February. These phenomena of prevalence are well calculated to make one hesitate in implicitly accepting views practically leading to the assumption that cases of so-called remittent and simple continued fever are, in greater part, really merely cases of enteric fever, and that in India we have practically to deal with the latter disease alone. The phenomenon of a double period of maximum prevalence of enteric fever is alone enough to excite suspicion. That any specific form of disease, so closely related to local conditions as enteric fever is, should possess two annual periods of excessive prevalence in one and the same place, at times when local conditions differ so greatly as they do during the hot weather and the latter part of the rains, is a most remarkable phenomenon, and one which calls for very special explanation. But this is not all, for we have also to explain the like phenomenon for the other forms of fever. Had we only to deal with double maxima of annual prevalence, the weight of evidence would, no doubt, tend rather in favour of the identity of all three forms of fever; but, when we find that the period of absolute maximum of one form falls in the hot weather, and that of the other two during the latter part of the rains, this is no longer the case. Taking the facts as they stand, they do not appear to make for any belief in the identity of the various species included within the group of remittent and continued fevers, but rather, perhaps, to indicate the outcome of imperfect discrimination of distinct forms, one finding the local conditions prevailing during the hot weather, and the other those of the latter part of the rains specially favourable to its development. It appears possible that the curious fluctuations in prevalence, to a considerable extent, at all events, may be accounted for as the result of imperfect diagnosis, and that the increase of prevalence ascribed to remittent and simple continued fevers during the hot weather should really be credited to enteric fever, and that that of the latter disease during the latter part of the rains mainly ascribed to remittent and simple continued fevers. If this really be the case, the anomaly of special prevalence of one and the same disease in one and the same locality under very different local conditions would disappear, and the phenomena of prevalence would merely indicate that the local conditions of the hot weather were specially favourable to the occurrence of enteric fever, and those of the latter part of the rains to that of remittent and simple continued fever. This is, of course, not advanced as a fact, but merely as a tentative explanation of an obscure phenomenon, and as a caution against a too ready acceptation of belief in the essential identity of all forms of remittent and continued fever occurring in India."

Again, if the statistics of the 18 stations throughout India which have an average strength of over 1,000 be examined, it will be found that in 1888 those in the Bengal Presidency, taken together, had 35 per cent. of their enteric fever in the second quarter and 30 per cent. in the fourth quarter; while those of Madras and Bombay had 55 per cent. of theirs in the third quarter. In those of Bengal the other fevers had their maximum in the fourth quarter, in those of Madras and Bombay in the third quarter.

Stations of over 1,000 *average Strength.*

	Bengal Presidency.					Madras and Bombay Presidencies.				
	January to March.	April to June.	July to September	October to December.	Total.	January to March.	April to June.	July to September	October to December.	Total.
Enteric fever -	13	35	22	30	=100	11	19	55	15	=100
Other fevers* -	11	22	27	40	=100	10	19	41	30	=100

* Including remittent fever, simple continued fever, and ague.

As in former years, medical officers were unable to trace the causation of the disease, to point out in any given outbreak a definite insanitary condition to which the outbreak might with certainty be attributed. Cases seemed to come from the various barracks of a station without preference. Connecting links between the cases could not be discovered. The official supplies of food and drink were usually described as pure and good, though there was sometimes trouble with the milk-supply. In the very few cases in which the causation of enteric is definitely ascribed to impure milk, no actual proofs are brought forward. At the same time all the medical officers naturally regard with great suspicion the articles of food and drink which the soldiers procure for themselves casually in bazaars and villages. In the case of many admissions, especially in the Hill Stations, it is noted that the disease must have been contracted before arrival. Most medical officers consider climate to be a factor in the causation of the disease, but they differ considerably among themselves with regard to the amount of influence to be attributed to it.

Besides the more usual difficulties of diagnosis, there occurred some cases in which the doubt was between dysentery and enteric fever, and between enteric fever and abscess of the liver. Indeed, in a few cases the lesions described are so excessive in nature and so extensive in distribution as to raise the suspicion that the diagnosis ought to have been dysentery rather than enteric fever. In four cases abscesses of the liver were noted as co-existing with the intestinal lesions.

Bowel complaints.

Dysentery was more prevalent only in Bengal, diarrhœa only in Madras. Madras had the death-rates of both dysentery and diarrhœa increased, this being due to the inclusion of the Upper Burma statistics. The diarrhœa death-rate of Bombay was increased. The admission and death rates from dysentery were, as usual, higher in the Madras than in the other presidencies; and Bengal came second, as it most frequently does. In the army of India as a whole, the admissions from dysentery per 1,000 of strength was 31, and from diarrhœa 36, and the death-rates were 0·67 and 0·07 respectively.

All the ratios for 1888 were below the decennial average of 1870–79, except the death-rate from diarrhœa in Madras, which increased from nil to 0·21; and the death-rate from diarrhœa in Bombay, which was the same as that of the decennium (0·17).

Heatstroke.

In 1888 the admission and death ratios for heatstroke and apoplexy (3 per 1,000 and 1·10 per 1,000) were higher than in the previous year. But the ratios compare favourably with those of the decennium 1870–79.

Hepatitis.

There was an increase in the admission and death rates from hepatitis in the Bengal and Bombay Presidencies, a decrease in the Madras Presidency; but, as usual, the Madras ratios were higher than those of the other presidencies. In the army as a whole, the admissions under this head were in the ratio of 25 per 1,000, and the deaths 1·48 per 1,000. Statistics show that in the last few years both sickness and mortality from hepatitis have, after a period of diminution, tended to increase; but that all the ratios are still well below those of the decennial average.

Respiratory diseases.

The admission and death ratios from respiratory diseases were 31 and 0·83 per 1,000 respectively against 33 and 0·68 in 1887. The only ratio that was less favourable than those of the previous year was the death-ratio of the Bengal Presidency (1·03 against 0·76). This increase of mortality in the Bengal Presidency took place chiefly in the Punjab and in the Hill Stations. All the ratios, except that of mortality in Madras (0·64), were considerably below the decennial ratios.

Venereal disease caused directly 27 per cent. of the admissions, 0·4 per cent. of the deaths, and 7 per cent. of the invalidating in the European army of India. The admission-ratio rose about 10 per 1,000 above that of 1887. In the Madras Presidency only did the admission-ratio sink. Venereal disease.

Admissions from Venereal Diseases in the three Presidencies.

Presidency.	Admissions per 1,000.										
	1860–69.	1870–79.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.‡
Bengal - -	265	209	276*	276*	271	281	291	363	394	356	373
Madras - -	†	198	275	258	288	289	307	350	394	400	376
Bombay - -	†	191	269	261*	224	218	292	272	370	337	357
India -	†	203	250	260	265	270	294	343	389	361	371

* Excluding troops in Afghanistan. † Not available.
‡ Excluding troops on active service in Burma for the first three months.

In the Bengal Presidency venereal disease caused directly 27 per cent. of the sickness, 0·3 per cent. of the mortality, and 5 per cent. of the invaliding.

In the Madras army venereal disease caused 28 per cent. of the sickness, 0·9 per cent. of the mortality, and 12·5 per cent. of the invaliding directly, and, of course, still more indirectly. The ratio of admission to strength was, however, lower than in the two preceding years. In the Bombay army 26 per cent. of the sickness, none of mortality, and 6 per cent. of the invaliding were recognised as directly caused by venereal disease. The admission-rate was higher than that of any of the previous ten years, except 1886.

In the whole army of India 1,557 men were invalided, or 22·71 per 1,000 of average strength, against 1,443 and 22·57 in the preceding year. The ratio for 1888 was about 20 per 1,000 less than that of the decennium 1870–79, which was 43·04. The proportion of invalids to strength was, as usual, lowest in Bengal. It was highest in Madras. 39 per cent. of the total number invalided were discharged as unfit for further service. This proportion, as may be seen in the following table, was not out of the common. Only in Bombay was the proportion of discharge greater than in the previous year; but it was less than in the other two presidencies, Madras being highest. Invaliding.

Percentage of those invalided for discharge to total number invalided.

	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Army of India -	37	39	41	40	41	37	39
„ Bengal -	40	45	45	43	46	41	40
„ Madras -	38	40	36	47	42	43	43
„ Bombay -	26	21	33	29	28	22	29

The following table shows the diseases and disease groups which caused invaliding of not less than 1 per 1,000 of strength, and which caused at the same time not less than 5 per cent. of the total invaliding :—

Bengal.		Madras.		Bombay.	
Diseases.	Invaliding Rate.	Diseases.	Invaliding Rate.	Diseases.	Invaliding Rate.
Anæmia and debility -	3·36	Anæmia and debility -	4·05	Anæmia and debility -	4·86
Circulatory diseases -	2·33	Venereal diseases -	3·48	Circulatory diseases -	2·85
Nervous diseases -	2·30	Dysentery -	2·98	Nervous diseases -	2·43
Phthisis - -	1·46	Nervous diseases -	2·91	Hepatitis - -	1·85
Ague - -	1·29	Circulatory diseases -	2·49	Phthisis - -	1·76
Venereal diseases -	1·01	Hepatitis - -	1·85	Venereal diseases -	1·59
		Phthisis -	1·42	Rheumatism - -	1·17
				Other respiratory diseases -	1·09

The high place taken by venereal diseases in Madras is noticeable. They caused 12·5 per cent. of the invaliding in Madras, 6·4 in Bombay, and 4·9 in Bengal. In the army of India the diseases, taken more in detail than above, which gave the highest ratios were, in order, debility, secondary syphilis, mental diseases, dysentery, hepatitis, tubercle of the lungs, malarial affections, and palpitation. The chief nervous diseases causing invaliding were dementia, melancholia, epilepsy, and mania; the chief circulatory, palpitation, valve-disease, and varix.

There was an increase in the ratio of invaliding from mental disease in all three presidencies; and the ratio for India (1·37 per 1,000) was higher than it had been since 1884. Dementia and melancholia were the prevailing forms of alienation.

As regards the relation of invaliding to age, the percentage of those under 25 years to the whole number invalided was 46·58 for the army of India against 49·41 in the previous year. On the other hand, the percentages from 25 to 35 were higher than in 1887. The percentage of men under 25 in the strength of the army was 50 against 52 in the preceding year.

Next, as regards the influence of length of service in India upon invaliding, the following table shows that from 2 to 5 years is the time during which the largest proportion of men break down :—

Number of men under 2 years' and between 2 and 5 years' service invalided per cent. of total number invalided.

Service.	1888.	1887.	1886.	1885.	1884.
Under 2 years	29·01	25·02	24·31	22·56	24·19
2 to 5 years - -	52·11	52·88	49·85	54·64	49·97

In 1888 the percentage of men under 2 years' service to the whole number invalided was increased, the percentage between 2 and 5 years very slightly diminished. That 81 per cent. of the invaliding should be among men of not more than 5 years' Indian service appears nothing extraordinary, when it is seen from the following table that 76 per cent. of all the European soldiers in India were of not more than 5 years' Indian service :—

Table showing percentages of men up to 5 years' residence in the Army of India and percentages of these men invalided to total invalided.

Residence.	1888.	1887.	1886.	1885.	1884.	1883.	1882.
0 to 5 years' residence - -	76	73	75	73	75	75	72
Invalided - - -	81·12	77·90	74·46	77·20	74·16	76·75	74·65

A mass of information concerning the influence of age and length of Indian service on invaliding, as well as on mortality, will be found in the statements appended to this section. The percentage of invaliding in the first four years of service was 48 in the period 1871–75, 68 in the period 1881–85, and 65 in 1888; while the percentage of men in the first four years of service who were under 30 years of age has risen from 73 in 1871–75 to 95 in 1888. Of the men under 4 years of service in 1888 over 66 per cent. were also under 25 years of age.

The percentages of married to strength for 1887, 1888, and 1889 were respectively 3·90, 3·84, and 3·65. The proportion was much the highest in Madras, and was lowest in Bengal.

Statistics of women and children.

The mortality among women (21·07) was greater than it had been since 1884, inclusive. There were in all 68 deaths against 59 in the preceding year; there were 8 deaths from accidents attending childbirth and abortion, 14 from cholera (against 6 in the previous year), 6 from phthisis, 3 from dysentery and diarrhœa, 5 from enteric fever, 8 from remittent and simple continued fevers, 3 from heatstroke, and 21 from all other causes. The admission-rate for women of all three presidencies together was 815·1. The chief causes of admission into hospital were anæmia and debility, intermittent fever, abortion, and puerperal affections, simple continued fever, diarrhœa, eye

diseases, and respiratory diseases. In the Bengal Presidency the admission-ratio was 766·9 per 1,000, in Madras 970·4, and in Bombay 738·2. Of individual causes of admission, anæmia and debility gave rise to the highest admission-ratio in the Madras Presidency, intermittent fever in the Bombay Presidency, abortion and puerperal affections in Bombay, simple continued fever in Madras, eye diseases in Bengal (in the Bombay Presidency they were about one-half as prevalent as in the other two presidencies), and diarrhœa in Madras.

Throughout India the admission-rate for children was 561·9 per 1,000, divided among the three presidencies as follows: Bengal, 460·4; Madras, 883·6; Bombay 404·2. The Madras Presidency, was, therefore, by far the most unfavourable for children. The chief causes of sickness for the children of all presidencies taken together were, in order, respiratory diseases, diarrhœa, intermittent fever, anæmia and debility, eye diseases, and simple continued fever. These were the most prevalent diseases also for each presidency separately, and the great excess in the admission-rate for Madras was due to excessive admission-rates for every one of the above diseases. This excess is especially remarkable in the case of respiratory diseases, for whilst the ratio in Madras was 170·6 per 1,000, it was 57·3 in Bengal, and only 16·6 in Bombay. Diarrhœa also was twice as prevalent in Madras as in the other two presidencies.

For India, as a whole, the mortality among children (50·91) was somewhat less than it was in the previous year (51·79), due entirely to a reduction in the Madras ratio. There were in all 314 deaths against 328 in 1887. The chief causes of death throughout India were: convulsions (58 deaths), diarrhœa (42), anæmia and debility (35), teething (32), and respiratory diseases (32). In each Presidency taken separately also the same were the chief causes of death. Cholera comes next, having given rise to 14 deaths among 23 admissions, all in the Bengal Presidency.

Native Troops.

Sickness and mortality in 1888.

The health of the Native Army of India as a whole was favourable in 1888. The general admission and death rates were lower than those of the quinquennial period 1877–81; and of all the ratios of 1888 shown in the following table only the death-rate of men present with their regiments was higher than the corresponding ratio of 1887. This raised rate was due to cholera; and the increase of cholera mortality was chiefly in Upper Burma. Doubtless the exclusion of the Upper Burma statistics would make all the ratios shown below still more favourable than they already are:—

Sickness and Mortality during the years 1877 to 1888.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877–81 -	118,669	1,422	48	1·94	24·90	27·40
1877 - -	113,966	1,030	32	1·53	10·90	13·38
1878 - -	117,273	1,460	43	2·06	18·04	21·02
1879 - -	121,107	1,735	58	4·61	35·15	37·79
1880 - -	126,385	1,545	56	0·53	39·22	41·12
1881 - -	114,612	1,305	46	0·97	19·24	22·62
1882 - -	114,894	1,129	37	1·02	12·24	14·76
1883 - -	114,830	923	31	1·15	11·76	14·31
1884 - -	114,827	1,042	33	0·71	10·50	12·22
1885* - -	115,486	978	32	1·61	13·67	16·09
1886* - -	106,010	973	31	1·27	13·27	19·46
1887* - -	105,254	1,045	33	1·31	11·68	18·17
1888† - -	124,822	995	33	2·14	12·84	16·14‡

* Excluding men on active service in Burma.
† Including Upper Burma for the last nine months of the year.
‡ Including deaths in Upper Burma in the first three months of the year.

To ague was ascribed 44 per cent. of the total sickness. The ratio of admission from it was reduced from 473 per 1,000 in the previous year to 435. The Native troops were, as usual, more liable than their European brethren to ague and remittent fever, and less liable to simple continued and enteric fevers. During the year under review there were increased admission-ratios from cholera, small-pox, bowel complaints,

and venereal diseases, and a decrease in the ratios of fevers and respiratory diseases. Respiratory diseases were, as usual, the chief cause of mortality. They caused 21 per cent. of the total number of deaths, and cholera 17 per cent. Cholera, heatstroke, bowel complaints, circulatory diseases, and debility caused increased mortality, but respiratory diseases a smaller mortality. Scurvy was less prevalent, and caused fewer deaths.

Bengal Army.

The admission and daily sick rates of the Native Army of Bengal were less than they have been since 1883. That the death-rate is higher than that of the previous year is due to the inclusion of the statistics of Upper Burma for the first time.

Sickness and Mortality during the ten-year period, 1867 *to* 1876, *and of the years* 1877 *to* 1888 *compared.*

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from All Causes.	
1867–76	39,508	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	36,896	1,495	51	0·92	19·76	27·73†
1882	40,256	1,250	41	0·72	13·34	16·49
1883	40,932	985	32	0·56	10·55	13·98
1884	40,850	1,193	35	0·71	10·97	12·56
1885‡	40,753	1,076	34	0·29	10·11	14·18
1886§	40,547	1,065	34	1·87	14·45	22·29
1887§	42,586	1,057	35	1·50	12·63	19·95
1888‖	50,886	992	33	1·40	13·11	16·62¶

* Excluding troops in Afghanistan.
† These ratios are calculated on the total regimental strength, including the army in Afghanistan.
‡ Excluding men on active service in Burma and Egypt.
§ Excluding men on active service in Burma.
‖ Excluding men on active service in Burma for the first three months, and in Hazara for October and November.
¶ Including deaths in Upper Burma in the first three months of the year.

Ague caused 45 per cent. of the sickness. Its admission-ratio was reduced to 444 per 1,000 from 489 in the previous year. There was increased admission from small-pox, dysentery, spleen diseases, rheumatism, and venereal diseases, and decreased admissions from most of the other principal diseases, including cholera, fevers, diarrhœa, and respiratory affections. Of the total deaths 23 per cent. were due to respiratory diseases, and 11 per cent. each to remittent fever and cholera. Heat-stroke, dysentery, and diarrhœa were the chief of the diseases which caused increased mortality.

The ratios for the various geographical sections of the Army of Bengal are shown in the following table:—

Year.	Ratio per 1,000.											
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.		Quetta District.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1867–76	1,523	19·13	1,062	8·38	987	11·19	1,588	9·61	1,457	14·24	...	...
1877	1,492	19·64	768	5·19	642	9·52	906	7·41	1,248	8·85	...	...
1878	1,527	22·13	1,036	7·88	1,008	9·83	1,581	12·96	1,896	18·33	...	...
1879	1,816	25·57	1,658	11·05	2,038	36·17	2,303	16·07	2,173	47·64	...	...
1880	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02	...	...
1881	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	22·86	...	...
1882	1,569	18·22	1,081	10·01	1,083	9·98	1,248	7·18	1,268	13·30	...	...
1883	1,408	16·23	970	8·17	978	11·53	906	5·77	830	10·80	...	...
1884	1,367	14·61	929	6·00	1,188	10·62	1,312	7·84	1,083	8·49	...	...
1885	1,278	9·96	990	6·42	1,179	10·04	1,333	8·28	902	9·92	...	...
1886	1,692	38·45	896	5·35	1,349	13·64	1,386	6·90	779	8·61	1,637	86·02
1887	1,462	14·32	906	7·54	1,258	21·39	1,220	8·36	894	10·83	1,545	68·54
1888	1,107	18·81	830	8·08	998	10·19	1,171	9·11	789	10·05	1,337	22·07

The chief causes of sickness in the various geographical groups of the Army of Bengal are set forth in the following table :—

Groups.	Ratio of Admission per 1,000 of Strength.											
	Fevers.*		Bowel Complaints.		Spleen Diseases.		Respiratory Diseases.		Rheumatism and Neuralgia.		Venereal Diseases.	
	1887.	1888.	1887.	1888.	1887.	1888.	1887.	1888.	1887.	1888.	1887.	1888.
Lower Bengal and Assam - -	719	413	168	149	12	11	81	79	30	40	23	32
Gangetic Provinces - - -	362	320	64	72	6	6	29	24	26	27	26	23
Rohilkund and Meerut - -	628	469	85	56	7	4	68	39	26	25	52	49
Agra and Central India - - -	647	638	76	63	5	6	38	20	38	31	29	42
Punjab - - - - -	447	368	57	53	4	4	35	31	20	22	21	27
Quetta District - - - -	639	641	277	126	19	6	86	108	81	31	17	29

* Intermittent, remittent, simple continued, and enteric fevers.

Sickness due to fevers decreased in all the groups, except the Quetta district; sickness from bowel complaints in all, except the Gangetic Provinces; respiratory diseases in all, except the Quetta district. The highest admission-ratios from fevers were in the Quetta district and Agra and Central India; the highest from bowel diseases, spleen diseases, and respiratory diseases in the Quetta district and in Bengal Proper and Assam; the highest from rheumatism in Bengal Proper and Assam; and the highest from venereal diseases in Rohilkund and Meerut and Agra and Central India.

The chief causes of mortality in the different geographical groups were as follows :—

Groups.	Ratio of Death per 1,000 of Strength.									
	Cholera.		Fevers.*		Bowel Complaints.		Respiratory Diseases.		Total, all Causes.	
	1887.	1888.	1887.	1888.	1887.	1888.	1887.	1888.	1887.	1888.
Lower Bengal and Assam - -	1·77	·80	2·47	2·39	3·71	5·42	2·12	3·67	14·32	18·81
Gangetic Provinces - - -	2·01	·75	1·18	2·25	·50	1·05	·83	1·35	7·54	8·08
Rohilkund and Meerut - -	6·25	—	4·36	1·35	1·89	1·05	3·97	3·00	21·39	10·19
Agra and Central India - - -	1·57	—	·78	1·90	·52	1·71	1·83	2·09	8·36	9·11
Punjab - - - - -	·15	·52	2·30	2·02	1·12	·80	3·18	3·24	10·33	10·05
Quetta District - - - -	—	—	4·67	1·76	4·67	·88	34·27	10·59	68·54	22·07

* Intermittent, remittent, simple continued, and enteric fevers.

There was no mortality from cholera in the third and fourth groups, and mortality was increased only in the Punjab. The cholera ratios are much more favourable than those of the previous year. In Rohilkund and Meerut and in the Quetta district all the chief causes of death gave improved ratios. There was increased mortality from fevers, bowel diseases, and respiratory diseases in the second and fourth groups. In the Punjab cholera and respiratory diseases gave unfavourable ratios, and in Lower Bengal and Assam bowel complaints and respiratory diseases. The highest ratios from cholera, fevers, and bowel complaints arose in Lower Bengal and Assam; the highest from respiratory affections in the Quetta district. In this and the preceding table the marked gradual improvement in the health of the Native troops of the Bengal army serving in the Quetta district may be observed.

The only stations which had annual admission-rates over 1,500 per 1,000 were Tummoo with Phongbyin (3,293), Banda (2,372), Delhi (2,196), and Dibrugarh with outposts (2,171). Quetta, Jhansi, Shillong, Kaludanda, and Madhupur had ratios over 1,200.

The stations which recorded a ratio of mortality exceeding 20 per 1,000 of average strength were :—

Moradabad - - - - - - -	53·19
Alipore and Ballygunge - - - -	23·11
Quetta - - - - - - -	21·40
Shillong and outposts - - - -	20·56

The above list is much shorter than that of the previous year. Moradabad, Shillong, and Quetta appear in both lists. The ratios of Quetta and Shillong were lower than in 1887. The lowering of the Shillong ratio was due to an increase of strength, the number of deaths remaining the same. The increase in Moradabad was due to reduction of strength, the number of deaths having only risen by one. At Moradabad, Quetta, and Shillong the chief cause of death was respiratory disease; but at Alipore with Ballygunge, 11 out of the 19 deaths were from diarrhœa.

Twenty regiments of the Bengal army lost from present and absent deaths together over 20 per 1,000 of average strength. Two of them were on service in the Sikkim expedition, and six were in Upper Burma. The deaths of the 13th Bengal Infantry (ratio 35·76) and of the 32nd Pioneers (41·30), on service in Sikkim, were principally from respiratory diseases, especially penumonia, and from bowel complaints, especially dysentery. The regiments in Burma suffered loss chiefly from cholera, bowel diseases, remittent fever, and debility. The 5th Bengal Infantry arrived at Lucknow from Upper Burma in December 1887. Of the 34 men it lost in 1888, 26 died at their homes while on furlough or sick-leave. Fever of malarial character killed 5 of the 8 men who died with the regiment. The 27th Bengal Infantry at Bareilly, which arrived from Upper Burma in May 1888, lost 41 men, of whom 22 died with the regiment, mostly from bowel complaints, fever, pneumonia, and debility. At Nowgong the 1st Bengal Infantry, having arrived from Upper Burma in March 1888, lost 28 men, the 18 with the regiment chiefly from fevers, respiratory disease, and diarrhœa. In the 22nd Bengal Infantry at Ferozepore and the 37th at Sialkot, pneumonia was the main cause of the present deaths; in the 5th Bengal Cavalry at Meean Meer, pneumonia and fever; in the 34th at Jhelum, cholera and fever; in the 1–1st Gurkhas at Dharmsala, phthisis. The 23rd Pioneers, stationed in the Khojak Pass, recorded 11 deaths from pneumonia out of 21 present deaths. The 43rd arrived from Upper Burma at Shillong in April 1888, and lost during the year 21 men. Of the 19 present deaths, 5 were from pneumonia, 3 from other respiratory diseases, and 3 from malarial fever. The highest mortalities were, therefore, due directly or indirectly to service in Upper Burma.

The sickness of the Punjab Frontier Force was less than in the previous year, but greater than in any other year since 1883. At the same time the death-rate (15·61 against 11·87 in 1887) was considerably raised by an increase of cholera mortality. All the chief diseases afforded lower admission-rates than in the previous year, except cholera, heatstroke, venereal diseases, and some others. Of the admissions, 58 per cent. were from ague, 5 per cent. from dysentery, and 4 per cent. from respiratory diseases. The admission-ratio from ague was 299 per 1,000 less, that from dysentery 12 per 1,000 less, and that from respiratory disease 7 per 1,000 less than in 1887. Among the diseases which caused increased mortality, the most important were cholera, respiratory disease, and fevers. Mortality from bowel complaints was lessened. Of the total deaths, 41 per cent. were from respiratory disease, 23 per cent. from cholera, and 10 per cent. from remittent fever. There were 45 deaths from cholera against 19 in the previous year, and the ratio rose 2·03 per 1,000. The deaths from respiratory disease were 80 against 59; and the mortality rose 1·5 per 1,000, and the fatality 3·01 per cent. The highest admission-rates, all above 1,700 per 1,000, were at Loralai, Dera Ismail Khan, and Edwardesabad; but of these, only the first was higher than in the previous year. The only death-rate over 20 per 1,000 (22·34) was that of Kohat, where the most cholera occurred. Five regiments had death-rates over 20 per 1,000, the height of the ratios being mostly due to cholera. Thus, the highest ratio (50·11) was that of the 5th Punjab Infantry at Kohat from 39 present and 6 absent deaths, 21 of the present deaths being from cholera and 9 from pneumonia. The 1st Punjab Infantry at Edwardesabad had the greatest number of deaths from pneumonia (10) in addition to 5 from cholera.

The health of the Corps in Central India and Rajputana was, as regards all the ratios, more favourable than in the previous year. The admission-rate declined from 755 per 1,000 to 658, the daily sick-rate from 20 to 17, and the death-rate from 7·16 to 5·54. All the chief diseases gave rise to lower admission-rates than in the previous year. Ague caused 43 per cent. of the sickness, and eye diseases 6 per cent. There was no cholera in 1888. The rates of death from cholera, fevers, and respiratory diseases were lowered, and those from dysentery and diarrhœa were not increased. Of the deaths, 28 per cent. were from respiratory disease and 10 per cent. from hepatitis. The admission-ratios of all the stations were below 1,000 per mille. The highest was 937 at Sehore with Indore and outposts, and that was better than in the

previous year. None of the regiments had a mortality exceeding 10 per 1,000, or a greater number of present deaths than 7.

Though one of the regiments of the Hyderabad Contingent was serving in Burma, it is satisfactory to observe that the statistics of the force were, on the whole, not unfavourable. Though the daily sick and admission rates were increased (from 614 and 20 respectively to 734 and 27), the death-rate was very considerably reduced (from 9·16 to 6·73), part of the reduction being in cholera. There was an increase in the admission-rates from most of the chief diseases, but more especially from ague and remittent fever. Ague caused 42 per cent. of the total sickness. There was an increase of death from debility and some other causes, but the decrease in numerous other cases resulted in the reduction of the total death-rate by 2·43 per 1,000. None of the stations had admission-ratios over 1,000 per mille. The highest ratio was 981 at Ellichpur. That of Amraoti fell to 417 in 1888 from 1,160 in 1887. All the death-rates were below 20 per 1,000. The highest was 17·39 at Amraoti, but this was from only two deaths. Only two of the regimental admission-ratios were above 1,000 per mille; that of the 4th Cavalry (2,376) at Mandalay in Upper Burma, and that of No. 1 Field Battery (1,697) at Ellichpur. In the case of the latter, most of the sickness was due to ague, and in the case of the former to ague, remittent fever, dysentery, and diarrhœa. The 3rd Cavalry at Bolarum was the only regiment which had a ratio of mortality exceeding 20 per mille (23·77), from 8 present and 5 absent deaths. Five of the present deaths were from debility.

Madras Army.

The inclusion of the Upper Burma statistics for the first time has raised all the ratios of the Madras army, as shown in the following table. The raising of the death-rate of men present with their regiments was in a great measure due to cholera.

Sickness and Mortality during the last Twelve Years compared.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877	28,304	861	28	2·79	11·80	14·36
1878	28,728	841	29	2·23	12·25	15·49
1879	27,314	1,269	43	3·19	18·89	21·23
1880	28,710	1,399	54	0·10	15·57	19·54
1881	28,533	997	41	1·37	12·02	16·75
1882	27,654	879	30	2·46	12·01	14·99
1883	27,703	737	27	2·92	10·76	12·51
1884	28,050	836	31	1·46	10·02	11·82
1885*	27,043	675	25	1·29	9·69	13·96
1886†	22,070	756	30	2·54	14·05	21·25
1887†	20,031	772	32	1·49	11·53	22·22
1888§	25,671	886	36	4·17	15·31	20·10‡

* Excluding men on active service in Burma and Egypt. † Excluding men on active service in Burma.
‡ Including deaths in Upper Burma for the first 3 months of the year.
§ Excluding men on active service in Burma for the first 3 months.

The diseases which produced the greatest increase of admission were cholera, ague, remittent fever, dysentery, and diarrhœa. Of the total admissions, 37 per cent. were from ague and 9 per cent. from bowel complaints. By far the greatest increase of mortality was in cholera, the ratio being furnished by 107 deaths against 30. The ratios from remittent fever and dysentery were also increased; but that from respiratory diseases was diminished. Of the total deaths, 27 per cent. were from cholera, and 9 per cent. each from remittent fever and debility.

Of the stations on the peninsula, only Secunderabad, Raipur, and Bellary had admission-ratios over 1,000 per mille; in all three the ratios were higher than those of the previous year. Bellary was the only one of the three which had a death-rate much above that of 1887. Its increased sickness was mainly due to fevers, dysentery, and spleen affections; its increased mortality to cholera and remittent fever. None of the peninsular stations had a death-rate over 20 per 1,000.

Rangoon and the Andamans and Nicobars were the only old established Burma stations which had admission ratios over 1,000 per mille. The ratio of Rangoon was higher than in the preceding year; that of the Andamans lower. There was increased fever and dysentery, &c. in Rangoon, and diminished fever, dysentery, &c. in the Andamans. The mortality in both was less than in 1887. In fact, none of the old stations had a mortality exceeding 13 per 1,000. On the other hand, the stations of Upper Burma as a group had an admission-rate of 1,653 and a death-rate of 49·58.

All the regiments of the Madras army which had a mortality over 20 per 1,000 were serving in Burma, or had just arrived therefrom. Thus the increased sickness and mortality at Bellary, above referred to, occurred in the 14th Madras Infantry which arrived from Burma only in February 1888. The highest mortality of all was 85·90 in the headquarters of the 6th Madras Infantry at Mandalay (Shore). This ratio was from 36 present and 3 absent deaths. Of the 36 deaths with the regiment, 17 were from cholera, 7 from dysentery, 5 from debility, and 4 from diarrhœa. All the regiments with a very high mortality suffered from cholera.

Bombay Army.

The improvement in the health of the Native Army of Bombay, noted in last year's report, was still further advanced in the year under review. Notwithstanding the inclusion for the first time of the statistics of the (few) troops serving in Upper Burma, all the ratios, except the daily sick-rate, shown in the following table are lower than the corresponding ratios of 1887:—

Sickness and Mortality during the last Twelve Years.

Year.	Average Strength.	Ratio per 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877 - -	23,388	1,074	33	1·93	10·90	12·96
1878 - - -	23,672	1,702	45	2·36	15·12	17·95
1879 - -	22,854	1,663	51	3·11	20·22	21·90
1880* - - -	15,328	1,283	45	—	10·44	56·53‡
1881* - -	18,349	1,166	41	1·85	14·01	25·93‡
1882† - - -	23,772	1,067	36	0·46	12·16	13·41
1883 - -	23,576	994	35	0·47	12·81	14·96
1884 - - -	23,373	1,153	38	0·39	12·96	14·35
1885§ - -	22,701	1,243	43	5·42	24·84	26·01
1886§ - -	21,089	1,231	37	0·14	15·98	20·89
1887§ - -	20,353	1,092	34	0·69	11·50	15·45
1888‖ - -	23,570	1,080	35	1·57	10·52	13·37¶

* Excluding Afghanistan. † Including troops in Southern Afghanistan.
‡ These ratios are calculated on the total regimental strength, including the army in Afghanistan.
§ Excluding men on active service in Burma and Egypt.
‖ Excluding men on active service in Burma for the first three months of the year.
¶ Including deaths in Burma in the first three months of the year.

Decrease of sickness was most marked in the case of respiratory diseases, but occurred also in all the fevers except ague, in diarrhœa, rheumatism, spleen diseases, guinea-worm, and injuries. There was increase of cholera, small-pox, ague, and some others. Of the total admissions, 39 per cent. were from ague and 8 per cent. from bowel complaints. There was a very marked decrease in the mortality from respiratory diseases, and more or less decrease also in that from all fevers except ague, from heatstroke, scurvy, debility, &c. On the other hand there was a very considerable increase in cholera mortality. Of the total deaths, 24 per cent. were from respiratory diseases, 15 per cent. from cholera, and 12 per cent. from remittent fever.

The only considerable garrisons with an admission-rate of over 1,500 per 1,000 were Baroda (1,965), Jacobabad (1,662), and the Quetta district (1,628). In the case of the two former the ratio was higher than that of the previous year. At Jacobabad the main increase was in fevers; at Baroda in dysentery, diarrhœa, cholera, and fevers. The death-rate at Jacobabad and Quetta fell, while that at Baroda rose from 3·14 to only 3·65. In none of the old stations did the mortality reach 20 per 1,000 of

strength, and in most it was under 10 per 1,000. But the death-rate of the Bombay troops in Upper Burma was 85·62.

Only seven regiments had a death-rate over 20 per 1,000. Of these, one was in Upper Burma, and one had just arrived from the same; two were in Quetta, and two had come from there. The highest ratio was 61·42 in the 1st Beluch Battalion at Fort Stedman in Upper Burma. This ratio was from 47 present and 10 absent deaths, 14 of the 47 being from cholera, 10 from fevers, and 10 from bowel diseases. The next highest ratio (24·63) was that of the 5th Bombay Cavalry at Quetta from 11 present and 4 absent deaths. Five of the present deaths were from pneumonia, and three from fever. Then came that (22·53) of the 3rd Beluch Battalion at Kurrachee from 10 present and 8 absent deaths, 6 of the 10 being from remittent fever and 2 from pneumonia.

Having considered individually the health statistics of the several portions of the Native Army of India in the foregoing paragraphs, it will now be convenient to contrast the main features of each division, and for ready reference the chief results are brought together in the following table:—

Presidency.	Total Deaths per 1,000, including Absentees.	Average Strength present with Regiments.	Ratio per 1,000.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Present Deaths from all Causes.
Bengal Native Army - -	16·62	50,886	992	33	1·40	13·11
Madras „ „ - -	20·10	25,671	886	36	4·17	15·31
Bombay „ „ - -	13·37	23,570	1,080	35	1·57	10·52
Corps of Central India and Rajputana	6·07	5,233	658	17	—	5·54
Punjab Frontier Force - -	18·18	12,426	1,369	36	3·62	15·61
Hyderabad Contingent - -	10·94	6,242	734	27	·96	6·73
India - - -	16·14	124,822	995	33	2·14	12·84

The Corps of Central India and Rajputana and the Hyderabad Contingent as usual recorded the lowest admission, daily sick, and death rates. The Punjab Frontier Force had the highest admission, daily sick, and death rates. If absent deaths be counted, the Madras army only had a higher death-rate than the Punjab Frontier Force. Cholera mortality was highest in the same two divisions. Only the Corps Central India and Rajputana were free from cholera.

To fevers returned as malarial were due 45 per cent. of the sickness and 15 per cent. of the mortality of the Native Army. But both admissions and deaths were in lower ratio than in 1887.

The ratio of admissions from enteric fever in the Native Army in 1888 was 0·1 per 1,000 of strength. Since, at least, 1880 this ratio has never been higher than 0·3, and has usually been 0·2. In the same period the extreme mortalities were 0·14 and 0·4. The mortality of 1888 was 0·06 against the maximum of 0·14 reached in the preceding year. The following table shows that the ratios for prisoners and Native troops are very like each other, and very unlike those of European troops.

	1877 to 1886.		1888.	
	Admissions.	Deaths.	Admissions.	Deaths.
European troops - - - -	8·9	3·15	13·6	3·75
Native troops - - - - -	·2	·10	·1	·06
Jail population - - - -	·2	·10	·2	·07

It is sometimes said that if there were more post-mortem examinations in fatal fevers of native soldiers, there would be a greater number of enteric fever cases returned by their medical officers. Now among the prisoners nearly every fatal case is subjected to post-mortem examination. Under these circumstances the fact that the ratios of prisoners and sepoys for a ten-year period are practically identical appears to show that the low return of enteric fever among the Native troops is not due to defective diagnosis. Again, the following table shows that it would be a mistake to

suppose that the fever mortality in the European and Native armies is the same in amount, only returned under different fever names :—

Mortality of Native Troops compared with that of European Troops in 1888.

Causes of Deaths.	Died per 1,000 of average Strength.		Relative Liability in Percentages.			Percentage in Deaths from all Causes.	
	European Troops.	Native Troops.	European Troops.	Native Troops.	Total: 100.	European Troops.	Native Troops.
Ague	·16	·58	21·6	78·4	100	1·1	4·6
Remittent Fever	·54	1·33	28·9	71·1	100	3·6	10·4
Simple Continued Fever	·03	·06	33·3	66·7	100	·2	·4
Enteric Fever	3·75	·06	98·4	1·6	100	25·2	·4
Total	4·48	2·03	68·8	31·2	100	30·1	15·8

The total fever mortality among Native troops in 1888 was to the total fever mortality among European troops as 1 : 2·2. For the period 1877–86 the corresponding ratio was 1 : 1·4. Again, among European troops, 30 per cent. of all deaths were from fever; only 16 per cent. among Native troops, in 1888. It would appear as if the Native were actually less susceptible to enteric fever than the European, a circumstance more easily explicable on a climatic theory of causation than on a pythogenic one. No reason has ever been suggested why the Native soldier should suffer less severely than the European from a filth-disease. But the Native soldier lives as he always has done since he was born, whereas the European has been transported to a climate totally unlike that in which he had hitherto lived, to an ardent climate, without a corresponding change in his diet, and with a great deal of change of habit, and of adaptation to new surroundings to be gone through. It may be worth noting here that the Native soldier suffers also much less than the European from tonsillitis and sore-throat.

Jails.

Sickness and mortality in 1888.

The augmentation in the jail population as shown in the subjoined table for the year under report would be misleading were it not explained that the figures of 1888 include, for the first time, the prisoners of a number of sub-jails in every province, as well as those of Europeans and of some newly established jails in Burma. The ratios given in the table show that the year was an unhealthy one compared with the five preceding ones. The admission-rate was 1,129 per 1,000, the daily sick-rate 38, and the death-rate 35·57 per 1,000. The mortality from cholera, 4·68 per 1,000, is the highest of the series given in the table. That from dysentery and diarrhœa, 10·65, was less than it had been during the three previous years, and was almost identical with that of 1883, which was one of favourable results generally :—

Statement showing the Strength, Sickness, and Mortality among the Prisoners of India during the years 1872–76, 1877–81, *and* 1882 *to* 1888.

Year.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from Dysentery and Diarrhœa.	Deaths from All Causes.
1872–76	99,758	1,016	?	2·86	13·48	36·24
1877–81	112,670	1,189	45	4·48	24·97	63·01
1882	94,063	1,214	42	2·75	15·21	39·96
1883	88,174	996	36	2·28	10·64	31·37
1884	85,496	1,025	37	1·43	9·73	29·11
1885	82,650	1,014	36	3·44	11·18	33·54
1886	84,910	1,014	56	1·45	10·70	31·85
1887	79,468	1,083	37	4·08	11·53	34·15
1888*	91,445	1,129	38	4·68	10·65	35·57
* Including sub-jails of Madras	92,559	1,121	37			35·29.

Intermittent and remittent fevers gave rise to higher admission and death-rates than in the previous year. Respiratory diseases were, on the other hand, less prevalent

and caused less mortality. Scurvy was somewhat more prevalent than even in the year before, though the resulting mortality was the same. Anæmia and debility together, though less prevalent, caused somewhat greater mortality than in 1887.

With the inclusion of a greater number of prisoners, as explained in the previous paragraph, there necessarily resulted a higher proportion of prisoners to the general population, the number of the latter remaining the same, namely, the census population of 1881. The ratio was 4·7 per 10,000 as compared with 4·1 in the previous year, and 4·4 in 1886. The subjoined table shows that each presidency contributed to the enhanced ratio :—

Ratio of Prisoners per 10,000 *of Population in each of the three Presidencies for* 1888, 1887, 1886, 1885, 1884, *and* 1872–76 *compared.*

Presidency.	Period.	General Population, according to Census of 1881.	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of Average Strength.
Bengal	1872–76	147,215,384	68,328	4·6	39·39
	1884		51,877	3·5	32·71
	1885		49,404	3·4	38·40
	1886		50,028	3·4	32·32
	1887		47,306	3·2	36·36
	1888		54,434	3·7	33·93
Madras	1872–76	31,170,631	9,607	—	32·37
	1884		6,959	2·5	20·55
	1885		6,942	2·2	17·86
	1886		6,904	2·2	17·53
	1887		6,057	1·9	22·12
	1888*		6,766	2·2	27·64
Bombay	1872–76	16,454,414	8,011	4·9	26·61
	1884		7,305	4·4	34·91
	1885		6,872	4·2	33·76
	1886		6,767	4·1	30·44
	1887		5,667	3·4	19·06
	1888		6,521	4·0	22·24

* Excluding sub-jails, the details of which have not been recieved.

The distribution of the main results of the vital statistics of the prison population among the three presidencies is shown in the following table. It will be observed that the admission, daily sick, and mortality ratios were greatest in the Bengal Presidency, least in the Bombay presidency, and intermediate in the Madras Presidency.

Sickness and Mortality among Prisoners in the three Presidencies during 1888 *compared.*

Presidency.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhœa.	All Causes.
Bengal	54,434	1,079	44	4·17	10·17	33·93
Madras*	6,766	720	27	1·48	9·90	27·64
Bombay	6,521	647	22	2·91	4·45	22·24

* Excluding the sub-jails, the details of which have not been received.

The admission-rate in the Bengal presidency was higher than in the previous year (1,079 against 1,020), but the mortality less (33·93 against 36·36). The mortality from cholera was somewhat less than in the previous year (4·17 against 4·21), and that from dysentery and diarrhœa considerably less (10·17 against 13·19). In the Madras Presidency both the admission and death rates were higher than in the previous year, the admission-rate having been 720 against 654, and the death-rate 27·64 against 22·12. The latter excess was almost entirely covered by the excess in the mortality from cholera and from dysentery and diarrhœa. Cholera gave rise to a death-rate of 1·48 against 0·16, and dysentery and diarrhœa to 9·90 against 5·95. In the Bombay

Presidency likewise both admission and death rates were higher than in the previous year, the former having been 647 against 559 and the latter 22·24 against 19·06. In this presidency, while cholera gave rise to greater mortality (2·91 against 1·24), dysentery and diarrhœa caused less mortality (4·45 against 6·88).

With a higher admission-rate than in any previous year since 1883 (inclusive), the death-rate as will be seen in the tables below was not unfavourable, having been smaller than that of the previous year and lower than in four of the six previous years. As already noticed, cholera caused much mortality. It is satisfactory to observe that the death-rate from bowel complaints was the lowest on record since 1877, and was less than one-half the average mortality ratio of 1877–1881.

The chief causes of admission into hospital are set forth in the following table, and are compared with the preceding nine years. Of the seven most usual causes of admission there given, only three, namely, fevers, diarahœa, and eye diseases, gave rise to higher rates than in the previous year; but compared with the decennial averages of 1873–82 four were in excess, namely, fevers, respiratory diseases, anæmia and debility, and eye diseases; leaving only three of these causes with diminished prevalence.

Statement showing the Chief Diseases which have caused Admissions into Hospital in the Jails of the Bengal Presidency from 1879–1888.

Number.	Diseases.	Decennial Average, 1873–82.	Admitted per 1,000 of Average Strength.									
			1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.	1880.	1879.
1	Fevers (including small-pox)	490	492	441	406	442	454	390	542	529	459	661
2	Dysentery - -	112	106	118	122	137	117	100	117	105	116	129
3	Diarrhœa - -	103	98	93	103	111	106	100	108	106	117	112
4	Respiratory diseases -	44	45	49	44	40	36	39	45	48	48	21
5	Anæmia and debility -	23	29	34	36	34	28	27	28	28	28	29
6	Rheumatism - -	17	14	15	15	16	16	16	16	15	15	15
7	Eye diseases - -	13	18	15	17	14	13	13	15	13	14	11
	Total of the Seven -	802	802	765	743	794	770	685	871	844	797	978
	Total from all Causes -	1,091	1,079	1,020	1,003	1,060	1,028	949	1,178	1,151	1,108	1,285

Of the seven chief causes of mortality given in the following table, three were more active than in the previous year, viz., fevers, anæmia and debility, and phthisis; but as compared with the decennial averages of 1873–82 all but cholera were less active, and the total mortality from all causes was 13·43 per 1,000 less than the decennial average. Dysentery and diarrhœa were, as usual, the most frequent causes of death, and after them respiratory diseases, cholera, fevers, anæmia and debility, and phthisis, in that order.

Statement showing the Diseases which have been the chief causes of Mortality amongst Prisoners of the Bengal Presidency from 1879–1888.

Number.	Diseases.	Decennial Average, 1873–82.	Died per 1,000 of Average Strength.									
			1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.	1880.	1879.
1	Dysentery and diarrhœa -	18·90	10·17	13·19	11·81	14·68	12·66	12·93	17·31	17·91	21·51	30·65
2	Respiratory diseases -	7·18	6·54	6·87	6·85	5·83	6·03	6·00	7·26	7·62	9·38	9·53
3	Fevers* - - -	5·40	3·09	2·58	2·82	2·57	2·30	2·49	3·58	4·70	4·46	14·11
4	Cholera - - -	3·46	4·17	4·21	1·78	4·07	1·32	2·35	3·11	3·10	1·00	6·38
5	Anæmia and debility -	3·10	2·20	2·05	2·60	2·49	2·10	2·02	3·04	2·58	3·66	5·43
6	Phthisis pulmonalis -	2·50	2·17	1·86	2·24	2·41	2·12	2·31	1·98	2·24	2·58	3·00
7	Spleen diseases - -	0·35	0·28	0·39	0·38	0·20	0·27	0·34	0·19	0·22	0·57	0·31
	Total of the Seven	40·89	28·62	31·08	27·48	32·25	27·00	28·44	36·47	38·37	43·11	69·41
	Total from all Causes -	47·36	33·93	36·36	32·32	38·40	32·71	34·28	42·36	44·42	51·12	77·90

* Including small-pox.

The death-rates from dysentery and diarrhœa separately were as follows compared with the previous year:—

	Ratio per 1,000 of Average Strength.	
	1888.	1887.
Dysentery - - - -	6·96	8·64
Diarrhœa - - -	3·21	4·55
	10·17	13·19

There was only one death from enteric fever against four in the previous year, but 25 deaths from cerebro-spinal fever against 15.

As usual, the health of the prisoners of the Gangetic Provinces and Oudh was the best, and that of Lower Bengal and Assam the worst. With regard to the remaining four it is difficult to assign to them any sequence, if we take into consideration the three main factors, namely, admission, daily sick, and death rates together; for whilst, for example, in the Punjab the admission-rate is extremely high (second only to Bengal), the daily sick-ratio is small, and the death-rate higher only than that of the Gangetic Provinces, which is the lowest. With regard to admission-rates the sequence in order of healthiness is Gangetic Provinces, Agra and Central India, Central Provinces, Rohilkhund and Meerut, Punjab, and Bengal. With regard to daily sick the sequence is Gangetic Provinces, Central Provinces and Punjab equal, Agra and Central India, Rohilkhund and Meerut, and Bengal. Lastly, with regard to mortality the sequence again commences with the Gangetic Provinces, continuing with Punjab, Agra and Central India, Rohilkund and Meerut, Central Provinces, and Bengal.

Statement showing the Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged in Groups in accordance with their Geographical Positions) in 1877–81, 1884, 1885, 1886, 1887, *and* 1888.

Groups.	Average Strength.	Ratio per 1,000.					
		Admissions into Hospital.	Daily Sick.	Deaths from			Difference between Average Mortality and Year's Mortality.
				Cholera.	Dysentery and Diarrhœa.	All Causes.	
I.—Lower Bengal and Assam	1877–81	14,788	1,519	50	7·43	31·63	67·50	—24·94
	1884	12,250	1,586	55	4·24	25·06	57·71	
	1885	12,148	1,642	58	7·24	28·73	60·50	
	1886	12,076	1,448	49	4·14	17·97	43·97	
	1887	10,157	1,513	49	1·38	15·75	35·64	
	1888	12,358	1,441	48	9·31	12·54	42·56	
II.—Gangetic Provinces and Oudh	1877–81	22,769	695	25	3·21	13·98	33·29	— 3·88
	1884	15,822	629	24	0·88	8·91	21·05	
	1885	15,347	678	25	5·08	8·93	27·63	
	1886	15,949	612	24	0·56	7·40	21·44	
	1887	14,739	662	25	2·58	8·89	24·29	
	1888	16,662	758	26	2·88	11·38	29·41	
III.—Central Provinces (excluding Jubbulpore and Saugor)	1877–81	3,002	983	36	11·39	26·11	69·88	—27·77
	1884	2,259	902	34	0·44	22·13	45·15	
	1885	2,285	938	38	15·32	29·76	68·71	
	1886	2,458	1,078	39	10·17	32·14	67·13	
	1887	2,571	852	30	19·06	28·78	71·96	
	1888	2,755	842	28	—	19·60	42·11	
IV.—Agra and Central India	1877–81	5,338	1,063	49	2·89	17·16	51·33	—20·39
	1884	4,224	640	24	0·24	7·34	19·89	
	1885	3,835	779	33	—	17·47	38·07	
	1886	3,651	892	32	—	12·87	33·69	
	1887	3,464	926	31	7·22	19·91	41·28	
	1888	4,396	785	33	—	8·19	30·94	
V.—Rohilkund and Meerut	1877–81	9,072	935	40	0·35	15·30	37·59	— 3·49
	1884	6,054	1,074	34	1·82	7·93	25·60	
	1885	5,321	1,209	41	—	10·34	28·38	
	1886	5,142	1,051	37	0·97	8·36	29·17	
	1887	5,100	920	34	0·59	8·24	33·53	
	1888	5,455	990	41	—	8·62	34·10	
VI.—Punjab	1877–81	14,180	1,674	51	2·38	31·64	88·13	—57·45
	1884	11,268	1,131	27	—	7·10	28·04	
	1885	10,468	1,000	25	—	4·68	27·13	
	1886	10,752	1,082	26	—	8·09	28·46	
	1887	11,275	1,158	26	6·21	13·12	44·43	
	1888	12,808	1,336	28	5·00	5·70	30·68	

The admission-rate in the jails of the province of Bengal was lower than in the previous year, but was still very high (1,347 against 1,388); the daily sick ratio (46)

did not however rise. The total mortality rose considerable (from 33·32 to 44·65), due mainly to increased mortality from cholera, which was very severe in incidence. The continued reduction in the mortality from bowel complaints is a very satisfactory feature in the statistical history of these jails.

Of the seven jails in this province with a strength exceeding 500 prisoners, all but one recorded admission-rates exceeding 1,000 per mille, the exceptional one being the Bhagulpur Central Jail (872). Of the other six, two recorded rates above 1,500, viz., Rajshahai (1,899) and the Presidency jail (1,538). Again, of these seven jails, four recorded higher admission-rates than in the preceding year. The increased sickness in the Rajshahai jail was due mainly to cholera, fevers, bowel complaints, respiratory diseases, and phthisis. Of these large jails, the Rajshahai, Buxar, and Presidency prisons all recorded admission-rates for ague over 500 per 1,000 in the above order. The Presidency jail was also conspicuous in recording the highest admission-ratio for remittent and continued fevers. With regard to mortality in these seven jails it is to be observed that in five of them the total death-rates exceeded those of the previous year. The highest death-rate, 133·59 per 1,000, was recorded in Rajshahai, the second highest, 43·60, in Midnapore, and the lowest, 9·05, in Buxar. In the Rajshahai jail there were 103 deaths in all, no less than 51 having been caused by cholera, 21 by fevers, 17 by bowel complaints, 6 by phthisis, 3 by respiratory diseases, and 5 by other complaints. In Midnapore there was no mortality from cholera; but, of the 30 deaths recorded there, 18 were due to bowel complaints and 7 to phthisis. In the Alipore jail there were 58 deaths, 16 of which were due to cholera, 11 to respiratory diseases, 7 to fevers, 6 to phthisis, and 5 to bowel complaints. In the Dacca jail the highest number of deaths from any one cause was 10, due to phthisis, out of a total of 35 deaths. In Buxar there were 9 deaths in all, 4 of which were due to bowel complaints and 3 to respiratory diseases.

Of the jails containing 100 to 500 prisoners the following were conspicuous in having recorded admission-rates over 1,500 per mille:—Rungpore (2,202), Champarun, Backergunge, Dinapore, Moorshedabad, Fureedpore, and Chittagong (1,690). Among these jails the ratios of Rungpore, Backergunge, and Chittagong only were in excess of those of the previous year. The increase in Rungpore was chiefly due to the increased prevalence of cholera and fevers in the latter, and to bowel diseases and respiratory diseases in both. The death-ratios in these seven jails ranged from 174·10 per 1,000 in Rungpore and 61·14 in Dinagepore, the two highest ratios, to 22·60 in Champarun, the lowest. Of the very high ratio recorded in Rungpore, representing 43 deaths, no less than 93·12 per 1,000 were due to cholera (23 deaths). In the same jail 15 deaths were due also to bowel complaints. In the Gya jail, where there was no outbreak of cholera, of the 43 deaths recorded no less than 35 were due to bowel complaints. The lowest admission-rate, 331 per 1,000, was recorded at Monghyr, with a daily sick-ratio of 19 per 1,000; and the lowest death-rates were at Kishnaghur (8·33) and Durbhunga (6·99). The jails which were conspicuous for admissions for scurvy were Ranchee (78·3 per 1,000), Arrah (6·2), and Bhagalpur central jail (4·9).

The progressive increase in the mortality of the prisoners of the North-Western Provinces noticed in the preceding report has unfortunately been maintained, the death-rate having risen from 8·35 to 8·68. There has also been an increased admission and daily sick ratio, the former rising from 684 to 748 per 1,000, and the latter from 26 to 30 per 1,000. Cholera was less prevalent than in the preceding year, but the mortality from it (1·14 per 1,000) was nevertheless high for these provinces. It is also unsatisfactory to note the gradually increasing mortality from bowel complaints since 1881 (inclusive). The ratio for the year under review, 8·68, is almost exactly double that of 1883.

Of the six central jails in these provinces (all with strengths exceeding 500), namely, the Benares, Lucknow, Fatehgarh, Allahabad, Agra, and Bareilly central jails, three recorded admission-rates exceeding those of the previous year, viz., Benares, Lucknow, and Bareilly. The admission-ratios varied from 820 per 1,000 in Bareilly to 247 in Allahabad. Of the three jails recording higher ratios than in the preceding year, the main causes for the excess in Bareilly were fevers, bowel complaints, and anæmia and debility; in Benares the same with cholera added; and in Lucknow fevers and respiratory diseases. In the Agra and Bareilly jails the admissions for fevers were the highest, viz., under 400 per 1,000, whilst in the other four the ratios were under 200 per 1,000. With regard to the mortality in these six large jails, the ratios varied

from 38·98 per 1,000 in Allahabad to 13·63 in Fatehgarh. The mortality ratios in Benares, Fatehgarh, and Allahabad exceeded those of the preceding year. In the Allahabad jail there were 49 deaths in all, of which 20 were due to bowel complaints, 12 to respiratory diseases, 3 to anæmia and debility, and 1 to fever. Cholera broke out in only one of these large jails, namely, in Benares, where of the 44 total deaths it caused 21; the other main causes of mortality being bowel complaints (5 deaths), respiratory diseases (4 deaths), and anæmia and debility (7 deaths). In the Bareilly jail, of the 33 deaths recorded 12 were due to bowel complaints, 7 to respiratory diseases, 6 to anæmia and debility, and 4 to phthisis. In the Agra jail there was an unusually heavy mortality from phthisis, 9 deaths out of 27 having been due to it, the other main causes of death being anæmia and debility (5 deaths), respiratory diseases (4 deaths), bowel complaints (3 deaths), and fevers (2 deaths).

Of the district jails with a strength over 200 the following recorded admission-ratios over 1,000 per mille; Etah (2,324 per 1,000), Banda, Moradabad, Aligarh, Muttra, Kheri, Mirzapur, Hardoi, Gorakhpur, and Saharanpur. Of these, seven recorded higher ratios than in the previous year. In Muttra such excess was due to the greater prevalence of fevers, bowel complaints, and respiratory diseases; in Moradabad and Aligarh to the same diseases with spleen disease, phthisis, and anæmia and debility added; and in Banda to fevers, scurvy, bowel complaints, spleen disease, and respiratory diseases. With regard next to the mortality in these 10 jails, the ratios varied from 101·64 per 1,000 in Banda, the highest ratio of any jail in the province, and 77·25 in Muttra to 5·18 in Hardoi. In Banda there were 31 deaths in all, of which 15 were due to bowel complaints, 5 to respiratory diseases, 2 each to fever, anæmia and debility, and scurvy, and 1 to phthisis. In Muttra there were 18 deaths, of which 9 were due to bowel complaints and 5 to respiratory diseases. In Aligarh there were 23 deaths, of which 11 were due to respiratory diseases and 3 each to fever and bowel complaints. In Mirzapore there were 12 deaths, 4 due to bowel complaints, 2 to anæmia and debility, and 1 each to cholera and respiratory disease. In Moradabad there were 13 deaths, 4 due to bowel complaints, 2 to respiratory diseases, and one each to fever, phthisis, and anæmia and debility. Although the Meerut jail did not enter into the above list of ten jails showing the highest admission-rates, its mortality was very high. There were in all 42 deaths, 15 due to respiratory diseases, 8 to bowel complaints, 6 to anæmia and debility, and 3 to phthisis. In Gorakhpur there were 13 deaths from bowel complaints out of a total of 17 deaths; and in Gonda 11 out of 18 deaths were due to the same cause. The lowest admission-rates were recorded in the Allahabad central jail (247 per 1,000) and Gonda (248); whilst the lowest death-rates were 7·46 in Bahraich and 5·18 in Hardoi. Admissions for scurvy occurred in Banda (23·0 per 1,000), Kheri, and Fatehgarh central jail.

Although there was a very considerable increase in the admission-rate among the prisoners of the Punjab (from 1,158 to 1,336), with a rise also, though not so considerable, in the daily average sick ratio (from 26 to 28), the death-rate fell notably from 44·43 in the preceding year to 30·68 per 1,000. This fall is the more satisfactory in that it took place in a year of cholera prevalence. The increase in the admission-rate was mainly due to ague, respiratory diseases, eye diseases, typhus fever, cerebro-spinal fever, &c. Intermittent fevers served to swell the admission-rate considerably (772·8 against 614·8 in 1887). The mortality from cholera was somewhat smaller than in the previous year, when it was very high. The great reduction in the mortality from dysentery and diarrhœa is very satisfactory, the ratio of the year under review being the second smallest on record since 1877. There was also a marked reduction in the mortality from respiratory diseases, anæmia and debility, injuries, and from all causes other than the most common causes of death. There were in all 164 cases of cholera with 64 deaths, or 39·02 per cent. of seizures. The fatality of this disease among those attacked was remarkably smaller than in the previous year, when 88·61 per cent. of those attacked died, the actual numbers having been 79 seizures with 70 deaths.

Of the nine large jails in the Punjab with strengths exceeding 500 five recorded very considerably higher admission-ratios than in the previous year, viz., Delhi, Umballa, Lahore central, Rawal Pindi, and Peshawar. The rise in Peshawar, viz., from 877·5 to 1,995 per 1,000, was very striking. The main causes of increased sickness were intermittent fevers, dysentery, and diarrhœa, and spleen disease in Delhi; respiratory diseases, anæmia and debility, ague and bowel diseases in Umballa; intermittent fever and respiratory diseases in the Lahore central jail; cholera and ague, bowel com-

plaints, and anæmia and debility in Rawal Pindi; and all fevers, bowel complaints, respiratory diseases, and anæmia and debility in Peshawar. The death-ratios in these large jails varied from 12·82 per 1,000 in the Mooltan district jail to 57·68 in the Lahore central jail. Only three of these death-rates exceeded those of the preceding year, viz., those of the Montgomery, Rawal Pindi, and Peshawar jails. In the Lahore central jail there were 101 deaths in all, of which 30 were due to cholera, 24 to respiratory diseases, 20 to bowel complaints, 10 to fevers, and 7 to anæmia and debility. In the Chinawan jail there were 41 deaths, 14 being due to cholera and 16 to respiratory diseases. In the Rawal Pindi jail there were likewise 41 deaths, 19 due to cholera, 9 to fevers, and 7 to bowel complaints. In the Umballa jail the main causes of death were bowel complaints (10) and respiratory diseases (11). In Montgomery out of a total of 13 deaths 8 were due to respiratory diseases and 3 to phthisis. In Peshawar out of 10 deaths 6 were due to respiratory disease. In the Lahore district jail there were 25 deaths, 11 of which were due to respiratory diseases, 7 to bowel complaints, and 3 to fevers.

Of the smaller jails with strengths exceeding 200 only four recorded admission-rates above 1,000 per mille, viz., Amritsar (3,528), Dera Ismail Khan (1,605), Hissar (1,142), and Jhelum (1,106). Intermittent fever gave rise to an overwhelming proportion of admissions in Amritsar, and next to this bowel complaints and respiratory diseases. The death-rates in these four jails were, however, below those of the preceding year, with the exception of Jhelum. There were 15 deaths in Amritsar, due mainly to bowel complaints and respiratory diseases; 13 in Jhelum, due mainly to the same causes and fevers (5 deaths); 9 in Dera Ismail Khan, due mainly to respiratory diseases and fever; and 7 in Hissar, 6 of which were due to respiratory diseases. The lowest admission-rate was 317 per 1,000 in Sialkot and 491 in the Mooltan district jail. In four very small jails there were no deaths; but of those recording deaths the lowest ratios were 2·65 in Sialkot and 5·13 in Gurdaspur. Admissions for scurvy were made in 10 jails, the most prominent ratios being 30·3 per 1,000 in Abbottabad, 6·0 in Rohtak, and 1·3 in Rawal Pindi.

The health of the prisoners of the Central Provinces was better than it had been during several previous years. The admission and death rates (893 and 40·80 per 1,000) were lower than in any year since 1882 (inclusive), and the daily sick rate (28) lower than it has been since 1877. There was no mortality from cholera, and the death-rate from bowel complaints fell from 31·56 in the previous year to 17·14 per 1,000.

There are only three large jails in this province with strengths exceeding 500, namely, the Raipur, Nagpur, and Jubbulpore jails. The admission-rate in one of these, Nagpur, exceeded that of the previous year; but in the other two the ratios were considerably below those of that year. The mortality ratio in all three were lower than in 1887, and especially so in Jubbulpore. The increased admission-rate in Nagpur was due almost wholly to an increased prevalence of intermittent fevers. The reduced admission-rate in Raipur was due especially to a diminished prevalence of fevers, bowel complaints, and anæmia and debility; and in Jubbulpore to a lessened prevalence of intermittent fevers, bowel complaints, and anæmia and debility. The death-rate in Raipur was 23·11 against 34·43 in 1887. In this jail there were in all 15 deaths, 5 of them due to bowel complaints and 4 to respiratory diseases. In Nagpur the death-rate was 55·50 against 62·05 in the previous year; there were 52 deaths, 25 from bowel complaints, 8 from respiratory diseases, 5 from anæmia and debility, and 4 from scurvy. In Jubbulpore the death-rate fell from 67·35 in 1887 to 36·82. There were 43 deaths in all, 12 due to bowel complaints, 9 to anæmia and debility, 5 to phthisis, 4 to respiratory diseases, and 3 to fevers.

There are four other jails in the province with strengths over 100, viz., Sambalpur, Bilaspur, Hoshangabad, and Saugor. In all but Sambalpur the admission-rates were higher than in the previous year, ranging from 477 in Sambalpur to 1,379 in Saugor. The death-rates ranged from 24·19 in Bilaspur to 103·63 in Sambalpur. In the last-mentioned jail there were 20 deaths, 14 of which were due to bowel complaints. In Hoshangabad there were 16 deaths, 8 of which were due to bowel complaints and 3 to respiratory diseases. In Saugor there were 8 deaths, 5 of which were due to bowel complaints and 2 to anæmia and debility. The lowest admission-rate recorded was 164 per 1,000 in Bhandara (average strength 73), and the highest 1,398 in Nagpur. There were no deaths in seven small jails; the lowest death-ratio of the remaining was 14·29 in Seoni (average strength 70), and the highest 103·63 in Sambalpur. Admissions for scurvy were made in five jails, namely, Hoshangabad (6·0), Nimar (13·2), Nagpur (19·2), Jubbulpore (0·9), and Saugor (5·9).

The admission and daily sick ratios among the prisoners of the Berar jails (10·18 and 16 per 1,000) were higher than in any previous year since 1882 (inclusive); but the death-rate (12·77) was only about one-half what it was in the preceding year, and is among the favourable ratios of preceding years. Cholera was absent, and the mortality from bowel complaints was low, namely, 1·96 per 1,000. There were in all 13 deaths against 25 (including 8 from cholera) in the preceding year.

The Amraoti jail recorded an admission-rate of 901 and a death-rate of 13·40 against 607 and 38·69 in the previous year. The chief increase of sickness was in ague, and 23·81 per 1,000 of strength of the decrease in the death rate was due to the entire absence of cholera. All the other jails of Berar were also exempt from cholera. The admission and death rates of the Akola jail were 701 and 20·10 against 880 and 20·83 in 1887. There was lessened sickness from ague and bowel diseases. The number of deaths remained the same. There were no deaths at all in any of the other jails of Berar.

The increased strength of the jails of Burma is due, as already pointed out, to the opening of several new jails, rendered necessary by the acquisition of increased territory in Upper Burma. The admission-rate (1,205) rose considerably, and is the highest on record since 1877, and is considerably higher than the average of 1877–81; but the ratios of the present and of succeeding years cannot well be compared with those of preceding years, since they will include the health statistics of a different class of people in jails under different climatic and other conditions. Thus the daily sick ratio (51) is likewise considerably higher than it used to be. But the total death-rate (53·60) is not the highest since 1877, although it is high and above the average of 1877–81. Cholera was very prevalent, having attacked 265 prisoners, of whom 172 died, or 64·91 per cent. of those attacked. The mortality from bowel complaints has continued to fall since 1886 (inclusive), but the ratio (15·28) is still above the average of 1877–81.

The highest admission-ratios in jails of average strength over 500 were 2,049, with a daily sick rate of 75, in Mandalay, and 1,296, with a daily sick rate of 59, in Rangoon. Only in Thayetmyo and Bassein was the admission-rate below 1,000 per mille. Leaving out the new jail of Mandalay, the only one of the jails of over 500 strength which had less sickness than in 1887 was Toungoo. In Rangoon the increase of sickness was chiefly due to cholera, fevers, and respiratory diseases; in Moulmein to fevers, bowel diseases, and phthisis. The death-ratios of all these six jails were over 20 per 1,000, the highest being 150·10 at Toungoo and the next 79·08 at Moulmein. The Moulmein ratio was very much lower than in the previous year, reduction having taken place in all the more important diseases, such as cholera, fevers, bowel complaints, respiratory diseases, phthisis, and debility. The raising of the Toungoo death-rate was by cholera and bowel complaints; of that of Bassein chiefly by cholera; of that of Thayetmyo chiefly by bowel diseases. The death-rate of Rangoon was lessened, there having been fewer deaths from bowel complaints, debility, and respiratory diseases. There were 8 jails with an average strength between 100 and 500. The admission-ratios over 1,000 were 1,740 at Shwegyin, chiefly from ague and bowel affections; 1,633 at Minbu, chiefly from bowel complaints, fevers, and cholera; 1,510 at Akyab, chiefly from ague; and 1,333 at Pagan. Akyab and Kyaukpyu were the only jails of this group which had the death-rate under 20 per 1,000. In all the others cholera was the chief cause of death. The highest ratio was 269·23 at Pagan and 175·00 at Minbu.

Among all the jails of Burma Sandoway had the lowest admission-rate (184), and Tavoy the lowest death-rate (8·40). The highest admission-ratios from ague were those of Akyab and Taungdwingyi; the highest from scurvy those of Rangoon and Toungoo.

Although the admission-rate among the prisoners of Assam (1,454) continues to be very high, the ratio is smaller than in any year since 1883 (inclusive). The daily average sick rate (57) has fallen since 1885, but is still considerably higher than the average of 1877–81. Notwithstanding this the mortality has fallen very considerably, and the latest ratio, 29·57, is the lowest on record, and is about one-half the average of 1877–81. This favourable decline in mortality has moreover occurred in a year of some cholera prevalence. After an unusual complete freedom from mortality from this cause in the preceding year a death-rate of 4·13 was recorded. The great reduction in the mortality from bowel complaints (from 16·19 to 10·32) is also remarkable, the ratio being the lowest on record.

The Sylhet, Gauhati, Tezpur, and Telikhal jails had an average strength over 100.

All their admission-ratios were over 1,000, and all except that of Gauhati over 2,000; but they were all lower than in the previous year. All had less bowel and respiratory disease, the first and second less debility also, and the second and third less fever also. The highest admission-ratio was 2,460 at Telikhal. The Telikhal death-ratio was unchanged, but all the others increased, the chief causes being bowel diseases at Sylhet and Gauhati, and cholera at Tezpur. The lowest admission-rate in the province was 162 at Majuli, being the only one under 1,000. There were no deaths at Sibsagar, Telikhal, and Majuli. The next lowest ratios were 20·00 each at Dibrugarh and Nowgong. The highest ratios of admission from scurvy were at Dhubri, Shillong, and Sibsagar.

The health statistics of the prisoners of Madras are not so favourable as they were in the preceding year. The admission, daily sick, and mortality rates rose from 654, 24, and 22·12 respectively, to 720, 27, and 27·64, though they were all under the high averages of 1877–81. The increase in admission-rates was mainly due to the increased prevalence of intermittent fevers, bowel complaints, anæmia and debility; respiratory disease being diminished. The increased mortality was due mainly to bowel complaints and anæmia and debility. There were 67 deaths from the former and 22 from the latter. Cholera accounted for 10 deaths out of 15 seizures (66·67 per cent.).

Five of the Madras jails had a strength over 500. The highest admission (2,112) and daily sick (63) rates were those of the Rajamundry central prison, being the only ratios over 900 and 50 respectively. The ratios of all except the Vellore central prison were increased as compared with those of the previous year. At Rajamundry the increase was mainly in ague, bowel diseases, phthisis, and debility. Rajamundry had the highest ratios from ague and bowel complaints. The reduction of sickness at Vellore was specially in respiratory diseases; also in ague, bowel disease, and phthisis; and the total deaths were reduced from 12 to 3, the ratio for 1888 being only 4·18. Only in the Trichinopoly central prison and in the Madras penitentiary was the death-rate increased. In the latter there was increase of death from cholera, fevers, bowel disease, respiratory disease, and debility, the total number of deaths being increased from 8 to 22. In the former the death-ratio increased from 3·83 to 40·10 and the total number of deaths from 3 to 32. The increase was in bowel complaints, cholera, phthisis, and debility, the number of deaths from bowel complaints having risen from nothing to 18. Seven jails had a strength between 200 and 500. Of these the most unhealthy was Cannanore with an admission-rate of 1,392, a daily sick rate of 44, and a death-rate of 72·16, its admission and death rates being also higher than in the previous year. It had 28 deaths against 14, 5 from bowel disease, 4 from debility, and a number from diseases not specially apt to occur in jails. The most marked increase of sickness was at Tanjore from fevers and bowel complaints, and at Bellary from ague and debility; but in both the increased prevalence of sickness was accompanied by a diminution of mortality. The lowest admission-rate among the jails of Madras was 333 in the Coimbatore central prison, and the lowest death-rate 3·45 in the Bellary jail. Scurvy was reported only from the Cannanore jail.

There was a slight increase of sickness among the Bombay prisoners as compared with the preceding two years, though the daily sick rate (22) was smaller; and a slight increase in the death-rate as compared with the previous year. The death-rate, 22·24, was second only, however, to the most favourable ratio of 1887 (19·06). Fevers, bowel complaints, respiratory diseases, and anæmia and debility were all more prevalent than in the preceding year. Cholera was more prevalent and gave rise to 19 deaths out of 33 admissions (57·58 per cent.). The mortality from bowel complaints (4·45) was lower than it had been for several years. Respiratory diseases, anæmia and debility, remittent fevers, and apoplexy and heatstroke were also more fatal than in the previous year.

Five Bombay jails had an average strength over 500. Of these the most unhealthy was the Thana jail with an admission-rate of 1,103, a daily sick rate of 37, and a death-rate of 42·91. It was also the only jail in which increased sickness was accompanied by an increased death-rate. The increase of sickness over the previous year was in respiratory diseases, cholera, ague, bowel diseases, spleen diseases, phthisis, and debility. The Thana jail had the highest admission-rates from remittent fever, bowel diseases, and respiratory diseases. The Yerrowda jail, the largest of all, had lessened sickness, most marked in the case of respiratory diseases; and the Bijapur gang had diminished sickness, most marked in ague, bowel disease, and phthisis. The Hyderabad and Shikarpur jails had diminished mortality, respiratory disease being

the chief cause of death in each. Thana, Yerrowda, and the Bijapur gang had increased mortality. The chief increase at Thana was in cholera, respiratory disease, and phthisis; at Yerrowda in bowel disease and debility; and in the Bijapur gang in fevers and respiratory disease. Of the seven Bombay jails between 200 and 500 in average strength Kurrachee had the highest admission-rate (1,232), the only rate above 1,000. Kurrachee had also the highest admission-ratios from ague, bowel complaints, and respiratory diseases. Only Kurrachee and Dharwar had higher admission-rates than in the previous year; due in the former to ague, non-malarial fevers, bowel complaints, spleen affections, respiratory diseases, and debility, and in the latter to various minor diseases. Dharwar and the Bombay House of Correction had lower death-rates than in 1887, all the others higher. At Dhulia and Ahmedabad the increase was due to the occurrence of cholera. At Kurrachee the chief cause of increase was bowel disease; at Nara bowel and respiratory diseases. The House of Correction showed a marked decrease in mortality from bowel complaints. The lowest admission-ratios in the jails of Bombay were 84 at Ahmednagar and 112 at Aden, and the lowest death-rate 4·95 at Dharwar. The highest ratios of admission from scurvy were those of Alibagh and Kolhapur.

In the Andamans, sickness, judged from the admission and daily sick rates, was less prevalent than in the preceding year, but mortality higher, the death-rate having risen from 23·03 to 40·99, which is higher than it had been during the previous six years. There was unfortunately a considerable rise in the mortality from bowel complaints, the ratio being higher than in any of the preceding six years, and higher than the average of 1877–81. Intermittent and remittent fevers also gave rise to a greater number of deaths. In addition to these diseases, the following gave higher death-rates than in the preceding year; respiratory diseases, anæmia and debility, sloughing ulcer and phagedæna, injuries, and all other than the common diseases.

Comparing together the results of the several provinces, we arrive at the following conclusions. The admission-rates were higher in Assam, the Andamans, Bengal, the Punjab, and Burma than the average rate for all the jails of India together; and the above order represents the order of excess beginning with the highest. With regard to the daily sick ratios, those of the Andamans, Assam, Burma, and Bengal exceeded the ratio for the whole of India in that order. With regard to cholera mortality, the ratios of Burma, Bengal, and the Punjab exceeded the ratio for all India in that order. The Burma ratio (16·64) was by far the highest. In the Central Provinces and Berar alone of the provinces there was no mortality from this cause (the disease has never been known in the Andamans). With regard to bowel complaints, the Central Provinces, Burma, Bengal, and the Andamans are conspicuous as having higher mortality ratios than the average for all Indian jails together, in that order. The jails which recorded the lowest ratios were Berar (1·96), Bombay (4·45), Punjab (5·70). Lastly, with regard to total mortality, the jails whose ratios exceeded the average ratio for all prisons were, in order, Burma, Bengal, the Andamans, and the Central Provinces. The lowest ratios were recorded in Berar (12·77), Bombay (22·24), and Madras (27·64). General remarks.

General Population.

The best results in birth registration come again from the Central Provinces and Berar, in both of which the provincial ratio is above 40 per 1,000. In the North-Western Provinces (38·25), Punjab (37·32), and Bombay (38·57), ratios are also high and indicate fairly good work. In the remaining provinces the ratios are evidently defective, and this is especially observable in Lower Bengal, where the provincial ratio is the lowest recorded, excluding only Coorg. If we may take a small difference between the lowest and highest district ratio in each province as indicating good registration, Berar shows the best work, with such a difference of 8·1 per 1,000. The Central Provinces and Assam come next, showing differences of 14·37 and 15·70 per 1,000 respectively. The difference is most excessive in the Punjab (40·44) and Bengal (53·52). General remarks.

The highest death-rate (30·08) was recorded by the North-Western Provinces, and next in order come the Punjab (29·89), Central Provinces (28·70), Bombay (28·44), and Assam (27·98). In no less than 7 of the 11 provinces enumerated in the following table was the death-rate below that of the previous year, and this was especially striking in Berar (viz., 24·7 in 1888 against 45·3 in 1887). The only province which

recorded a higher ratio than in the previous year are Assam, Lower Burma, and Bombay. The highest mortality from cholera was recorded in Lower Burma (4·37), Bombay (2·22), and Madras and Assam, each of which contributed 2·1 per 1,000. Small-pox gave rise to the greatest mortality in Mysore (1·38). Central Provinces (1·22), and Punjab (0·90). Fevers were most fatal in the North-Western Provinces (23·89) and Punjab (20·16); the smallest recorded ratio was 7·3 per 1,000 in Madras.

Statement showing the Deaths from All Causes according to months in the different Provinces of India during the year 1888.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratios of Deaths per 1,000 of Population. 1888.	1887.
Bengal	138,664	105,629	116,128	131,876	116,670	105,575	113,806	109,203	122,250	149,631	140,186	166,117	1,515,735	22·94	23·46
Assam	9,188	8,703	8,814	9,966	12,954	12,130	11,387	10,536	10,342	10,483	10,944	10,913	126,654	27·98	24·52
North-West Provinces and Oudh.	93,831	74,967	75,987	84,602	95,810	111,772	92,475	97,056	123,414	174,772	153,621	148,806	1,327,113	30·08	35·86
Punjab	49,083	37,810	33,853	33,332	41,737	46,775	42,842	42,369	49,070	64,170	62,828	58,860	563,229	29·89	34·31
Central Provinces	18,951	15,685	17,273	19,262	19,862	20,021	18,990	22,589	24,431	27,316	23,063	26,518	253,961	28·70	32·70
Berar	5,510	4,512	5,120	4,875	4,789	3,723	3,851	6,193	7,269	6,874	5,610	6,539	64,865	24·7	45·3
Lower Burma	5,228	4,819	5,942	6,230	6,157	8,173	12,795	11,904	7,467	5,838	5,372	5,561	85,486	23·40	16·18
Madras Presidency	73,080	52,417	47,077	41,850	42,442	43,586	42,599	47,353	44,845	44,510	47,147	61,101	597,015	21·4	21·6
Bombay „	32,491	29,904	33,992	35,317	39,780	45,066	45,397	45,921	41,133	41,269	38,284	39,485	*468,043	28·44	27·67
Mysore	5,439	5,550	5,776	5,424	5,850	6,403	6,442	6,049	5,830	5,841	5,841	6,346	70,791	17·30	18·59
Coorg	274	213	236	272	297	392	373	321	319	244	236	279	3,461	19·41	19·41
Total	430,849	340,214	350,198	373,000	386,348	405,916	397,957	399,994	436,368	530,948	493,132	530,525	*5,075,453		

* Including 4 deaths from cholera in Bombay, the monthly distribution of which is not known.

Registration continues to be very imperfect in Bengal Proper. Birth registration is still confined to selected municipalities, though their number is being gradually increased year by year. During the year under report 134 municipalities registered births against 100 in the previous year. The birth-rate in these averaged 20·63 per 1,000 against 19·35 and 21·04 in the two preceding years; they are evidently considerably under-rated. Individual ratios varied from 0·74 to 54·26 per 1,000. Deaths are recorded all over the province, but these statistics bear equal evidence of imperfection. The provincial average was 22·94 per 1,000, the mean of district ratios varying from 13·46 in the Sonthal Pergunnahs to 42·49 in the suburbs of Calcutta. The mean average provincial ratio for the preceding five years was 21·60. In rural circles the death-rate was 22·87, and in towns 24·86. Registration is compulsory in some towns, but even in these the results are sometimes evidently very imperfect. At Calcutta births were recorded at the rate of 19·95 per 1,000, and deaths at 26·97 per 1,000, against 18·36 and 25·34 respectively in the previous year.

Birth registration in the North-Western Provinces and Oudh is general, and the provincial ratio was 38·25 per 1,000 against 38·74 in the previous year. The reduced ratio was the result of widespread diminution in district ratios. Thus 30 of the 49 districts recorded a lower ratio than in 1887. The reduction, it is feared, must be attributed to imperfect registration. Renewed efforts are being made, however, to secure more trustworty results. The district ratios varied from 22·66 to 49·11. Deaths are also registered everywhere. The provincial ratio was 30·08 per 1,000, against 35·86 in the preceding year, and 32·79 the average of the preceding five years. No less than 43 of the 49 districts of the province shared in this reduced mortality as compared with the previous year. As death registration is imperfectly conducted it is impossible to decide how much of the reduction may fairly be attributed to better general health; probably the greater part must be owing to careless recording. This view is supported by the fact that seven districts recorded an excess of deaths over births, and without any special reason. On the whole, however, there was an increase of 8·17 per 1,000 to the population of the province by births.

The registration of vital statistics in the Punjab is still not satisfactory. The birth-rate was 37·32 against 38·88 in 1887. This decrease was widely distributed over the province, having taken place in no less than 20 of the 31 districts. The

district birth ratios varied from 13·02 to 53·46 per 1,000. The death-rate of the province also fell from 34·41 in 1887 to 30·0 per 1,000. This decrease, it is feared, must be more largely attributed to imperfect registration than to improved health conditions, as the year was one of cholera and small-pox prevalence. The provincial ratio was made up of district ratios varying from 18 to 42 per 1,000, the reduction being conspicuous in most of the districts of the Delhi division. In towns the ratios varied from 18 to 53.

The birth-rate of the Central Provinces, which had since 1881 always been above 40 per 1,000, sank suddenly to 37·79 in 1886, but recovered itself in the following year (40·20), and rose to 41·52 in the year under report. That this has been due mainly to improved registration appears to be supported by the fact that the range of variation in the component district ratios has become smaller in extent, namely, 33·02 to 47·39, against 31·00 to 50·13 in the previous year. The death statistics of the province show a marked decrease, and the sudden decline of the ratio to 28·70 per 1,000 from 32·70 in the previous year, and 32·40, the past quinquennial average, is stated to have been due to a diminished prevalence of fevers and bowel complaints. This, again, is attributed to the early cessation of the rains and to the total rainfall of the year being below the average. But the great disproportion between the deaths of males and females throughout the province as a whole, and in Saugor, Damoh, and Narsingpur in particular, in all of which the general health is stated by Civil Surgeons to have been bad owing to food scarcity, would throw some doubt on this view of the reduced death ratio. The district mortality ratios varied from 23·22 to 34·86.

Registration in Berar is probably more accurately performed in this province than in any other in India. The birth-rate was 41·3 per 1,000, a ratio which has only been exceeded in three previous years since the commencement of registration in 1868. But, while the total result shows that birth registration is generally well performed, there are particular instances of neglect. Thus, while in 1887 the birth ratio in towns varied between 16·9 and 51·5, in 1888 the extremes were 20·8 and 56·8; and, again, while Akola and Amraoti recorded birth ratios of 35·2 and 23·7 in 1887, in 1888, a comparatively healthy year, these ratios were 24·7 and 20·8 respectively. The death-rate fell from 45·3 in 1887 to 24·7 in 1888. This was probably due in great part, as claimed by the local authorities, to the healthiness of the year; but the variation in the death-rates of towns from 16·8 to 41·4 arouses the suspicion that it may also be attributed partly to relaxed care in registration. Small-pox alone among diseases and injuries gave rise to a larger number of deaths than in the previous year.

Some improvement may be recorded of the registration of vital statistics in Lower Burma. The birth-rate was 23·91 against 21·74 and 22·57 in the two preceding years. The ratio of the year under review is, however, in all probability still far below the truth. The limits of district variation were 11·91 and 35·06 per 1,000. The death-rate recorded was 23·40 per 1,000 against 16·18 and 15·54 in the two previous years. There has, therefore, been a marked improvement in death registration, and especially in towns; the results of rural circles showing little or no improvement. The district ratios varied between 10·25 and 50·72. It is hoped that greater accuracy will be obtained in future by the enforcement of the rules framed by several municipalities under the Burma Municipal Act.

The area and population under registration in Assam remained the same as in the preceding year, but the results of the year under review bear testimony to greater care having been bestowed in most districts upon the registration of vital statistics. The provincial birth-rate rose from 28·59 in 1887 to 31·62 per 1,000, and all districts, except Kamrup and Lakhimpur, contributed to this increase. The district ratios varied between 23·18 and 38·88. The death-rate also increased from 24·52 to 27·98, all districts except Cachar and Goalpara contributing to this rise. In the sadar and sub-divisional towns also, where registration is compulsory, the records of deaths show some improvement, but the variation in the ratios of individual towns is still very great. Special measures have, however, been taken to secure better results.

Registration continues to be very imperfectly done in Madras. The birth-rate for the presidency was 29·9 per 1,000 against 30·4 in 1887. Even in municipalities, where registration is compulsory, the birth ratios recorded were evidently in most cases considerably under-stated. The district ratios varied from 19·1 (Nilgiris) to 40·3 (Salem). The total registered death-rate was 21·4 per 1,000 against 21·6 in the previous year; both ratios are much under the truth. Although the total number of deaths registered was fewer than in 1887, yet cholera, small-pox, bowel complaints, and injuries gave rise to a larger number of deaths than in the preceding year, an

evidence that the reduced ratio of 1888 does not indicate a healthier year. The district mortality ratios varied from 12·5 in Vizagapatam to 37·8 in Madras, and the town ratios from 6·4 to 50·5.

Some progress in registration is observable in the returns of Bombay Presidency for the year. Most of the districts which showed advancement in the preceding year gave evidence of increased improvement, but the Sind and Ratnagiri districts are still backward. The average birth-rate was 38·57 against 38·18 in 1887, and 28·51 in the preceding 10 years. In rural tracts the ratio rose from 39·69 in 1887 to 40·07 in 1888, and in towns from 27·94 to 28·44. The district ratios varied from 21·30 in the City of Bombay to 51·78 in Dharwar. The death-rate of the presidency was 28·44, against 27·67 in 1887, and a mean of 25·10 in the preceding decennium. In towns the rate rose from 28·05 in 1887 to 31·35 in 1888, and in rural areas from 27·63 to 28·04. The increased mortality was, according to the recorded statistics, principally due to a greater death-rate from cholera, bowel complaints, injuries, and various diseases, grouped under the head "Other causes." The district mortality ratios varied from 11·98 in Upper Sind Frontier to 42·27 in Broach; in towns from 12·77 to 65·71 (Viramgám).

The birth-rate of Coorg was 16·61, or 2·13 greater than in the previous year, and the death-rate 19·41, the same as in 1887. These results show very little improvement, but registration in this part of India is attended with unusual difficulties. Attempts are, however, constantly being made to improve matters, and more especially in gaining the co-operation of coffee-planters.

History of Chief Diseases.

Cholera.

On the whole cholera was much less prevalent than in the preceding year, having given rise to 270,408 recorded deaths against 488,788 in 1887. But whilst this was the case for most parts of India, in others it was more prevalent. In Bengal, North-Western Provinces, Central Provinces, Berar, Rajputana, and Central India, the disease was less prevalent; but in Assam, Punjab, Bombay, Madras, Mysore, and Lower Burma there was a large increase of mortality, as may readily be seen in the subjoined table:—

Annual Deaths from Cholera in India, 1877 to 1888.

Province.	Population.	Deaths from Cholera.											
		1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Bengal*	66,163,884	155,305	95,192	136,363	39,643	79,180	182,352	90,439	134,421	173,767	118,368	172,578	111,391
Assam	4,526,959	11,377	6,732	17,415	2,803	5,010	21,055	14,908	22,276	7,753	20,188	7,941	9,693
North-Western Provinces and Oudh.	44,107,869	31,770	22,221	35,892	71,546	25,365	89,372	18,160	30,143	63,457	34,565	200,628	18,704
Punjab	18,842,264	29	215	26,135	274	5,207	39	190	614	1,936	12	8,804	14,938
Central Provinces	8,817,185	3,418	40,985	27,575	330	9,140	11,932	16,235	149	21,863	16,679	12,576	921
Berar	2,620,573	842	34,306	223	1	3,404	3,573	27,897	87	3,683	976	14,396	305
Rajputana	†	60	2,393	918	—	197	1,327	797	1,297	1,695	173	2,612	32
Central India	†	926	8,047	2,784	299	681	1,562	1,740	1,018	4,624	290	8,868	191
Bombay	16,454,414	57,228	46,743	6,937	684	16,694	7,904	37,954	13,804	37,287	167	25,711	36,500‖
Hyderabad	†	7,414	6,693	6	—	1,721	150	1,947	2,470	1,387	499	2,831	2,057
Madras	27,907,840‡	357,430	47,167	13,296	613	9,446	23,604	36,284	75,476	58,109	12,417	28,359	58,677
Mysore	4,092,648	2,902	723	14	25	25	893	124	330	2,677	10	832	1,015
Coorg	178,302	§	49	—	—	3	31	—	—	—	—	3	2
Lower Burma	3,653,629	7,276	6,759	1,828	2,638	5,239	7,177	2,185	5,515	7,685	4,027	2,649	15,982

* Excluding Calcutta. † Population not known. ‡ Excluding Europeans and Eurasians.
§ Statistics not available. ‖ Including 4 deaths, the monthly distribution of which is not known.

The disease was remarkably in abeyance in Rajputana, Central India, and Berar.

The seasonal prevalence of the disease in the various provinces is shown in the following table, and calls for little remark, as it is very uniformly repeated from year to year with only minor variation. Thus the month of minimum prevalence was October instead of February as in the preceding year, and that of maximum prevalence was June against July in 1887. The seasonal prevalence in the individual provinces presents no abnormality.

Statement showing the Deaths from Cholera registered in the different Provinces, by months, during the year 1888.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of Deaths per 1,000 of Population. 1888.	1887.
Bengal	5,172	3,817	10,575	17,216	14,263	9,550	8,686	12,081	7,032	4,635	7,067	10,698	111,391	1·68	2·60
Assam	600	613	970	1,422	1,829	2371	881	355	185	322	534	611	9,693	2·14	1·75
North-Western Provinces and Oudh.	59	100	238	1,714	4,536	4,812	1,545	1,303	946	1,890	992	569	18,704	0·42	4·54
Punjab	—	3	1	1	65	3,320	4,122	4,081	2,048	1,022	237	43	14,938	0·79	0·47
Central Provinces	—	—	1	50	389	372	48	76	1	—	—	4	921	0·10	1·43
Berar	46	—	—	—	—	1	7	77	145	24	3	2	305	0·1	5·5
Lower Burma	259	556	1,111	1,885	1,224	1,962	4,290	3,589	702	124	120	160	15,982	4·37	0·73
Madras Presidency	18,787	9,399	4,421	2,251	1,694	2,565	4,587	3,551	1,805	1,813	1,494	6,310	58,677	2·1	1·01
Bombay Presidency	499	203	895	2,815	5,672	9,804	5,992	3,968	1,760	2,377	1,471	1,040	36,500*	2·22	1·56
Mysore	5	38	5	3	3	—	—	29	273	296	201	162	1,015	0·25	0·20
Coorg	—	—	—	—	1	—	—	—	—	—	—	1	2	0·01	0·02
Total	25,427	14,729	18,217	27,357	29,655	33,757	30,158	29,110	14,892	12,503	12,719	19,600	268,128*		

* Including 4 deaths, the monthly distribution of which is not known.

In the next table various ratios are brought together to facilitate the comparison of provinces.

Province.	Mortality in 1888.	Mean mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in rural circles.	Maximum mortality in towns.	Month of maximum prevalence
Bengal	1·68	2·08	4·44	1·58	8·31	6·64	24·72	April.
Assam	2·14	3·23	4·05	2·09	10·84	5·54	31·96	May.
N.-W. Provinces and Oudh.	0·42	1·57	0·48	0·42	2·26	3·42	20·59	June.
Punjab	0·79	0·12	0·55	0·81	4·73	9·60	14·01	July.
Central Provinces	0·10	1·53	0·16	0·10	0·41	1·45	9·28	June.
Berar	0·1	3·5	0·2	0·1	0·70	0·2	2·8	September.
Lower Burma	4·37	1·21	4·10	4·41	17·57	24·19	17·49	July.
Madras	2·1	1·5	4·7	1·9	11·15	4·2	30·3	January.
Bombay	2·22	1·34	1·90	2·27	12·74	7·82	12·74	June.

Thus the incidence of the disease was most severe in Lower Burma. In the Punjab also the death-rate was greater than the average of the previous five years. In the Punjab, Lower Burma, and Bombay, the urban mortality was less than the rural, but in all other provinces the reverse was the case, notably in Bengal, Madras, and Assam. With regard to the diffusion of the disease in the provinces it is observable, from an inspection of the column headed Per cent. of villages attacked, that this was greatest in Lower Burma (17·57 per cent.), Bombay (12·74), and Madras (11·15), and least in the Central Provinces and Berar.

The next two columns show that in certain districts and towns the disease was extremely prevalent.

In the province of Bengal cholera was considerably less prevalent than in the preceding year. It gave rise to a mortality of 1·68 per 1,000 against 2·60 in 1887. It was also somewhat less diffused, 8·31 per cent. of villages having recorded deaths against 10·30 in 1887; but, on the other hand, no less than 96·8 per cent. of registration circles recorded deaths against 97 in the previous year. It was, as usual, present throughout the year, but there were three periods of exacerbation, the first in April, the second in August, and the last in December. The highest district ratios were returned by the suburbs of Calcutta (10·27 per 1,000), Champaran (6·62),

Maldah (4·47), Backergunj (4·12), and Manbhum (4·13). The mortality ratios for the several divisions were as follows :—

	Ratio per 1,000.		
	1888.	1887.	1883-87.
Burdwan	1·27	0·98	1·55
Presidency	2·60	2·08	3·02
Rajshahye	0·78	0·97	1·60
Dacca	2·06	2·73	2·49
Chittagong	1·31	1·39	1·30
Bhagalpur	1·04	1·74	1·34
Patna	1·92	4·67	2·21
Orissa	2·15	4·87	4·22
Chota Nagpur	1·88	2·45	1·11

It is thus evident that the diminished prevalence, with reference to the proportions attacked in each part of Bengal, as compared with 1887, was mostly enjoyed by the people of the Patna and Orissa divisions. On the other hand, the Burdwan and Presidency divisions suffered even more than they did in the severe year of 1887. Comparing next the ratios of the year under report with the preceding quinquennial averages, we find that in Chittagong and Chota-Nagpur only did the former exceed the latter, and in the case of Chittagong very slightly.

During the year 22,705 European seamen arrived in port against 23,585 in the previous year. The daily average population was 1,510 against 1,893 in 1887, and is the lowest on record since 1881. The health of the seamen unfortunately was not so good in 1888 as it was in 1887. Cholera gave rise to a mortality of 10·59 per 1,000, and all other diseases to 27·15 or 37·74 in all: the corresponding ratios for the previous year are respectively 10·03, 16·91, and 26·94. At the same time the total ratio of 1888 is less than the average for the three years preceding 1887. The cholera ratio also of 1888 was the lowest on record for the past eight years except those of 1885 and 1887. Bowel complaints were less prevalent than in 1887. There was also a decrease in the number of admissions to hospital for malarial fever. There were no deaths from small-pox—the eighth year of complete immunity. There was a large increase in the number of admissions into hospital for sunstroke, and also in the mortality rates from that cause. This is attributable to the exceptionally excessive heat which prevailed in June. The average native population of the port is estimated at 25,000, and the mortality rates are calculated on that basis. The death-rate was 5·77 per 1,000 against 3·4 in the previous year. The number of deaths from cholera (95 or 3·7 per 1,000) was considerably in excess of that for 1887 (1·91 per 1,000), and was higher than in any year since 1884 (5·3 per 1,000). Fevers gave rise to the same mortality, and bowel complaints to nearly the same as in the preceding year. For the third year this population enjoyed complete immunity from small-pox. The number of native seamen who arrived in port was 34,824 against 31,420 in 1887.

The disease gave rise to a greater mortality than in the preceding year, viz., to 2·14 per 1,000 against 1·75 : it was less, however, than the quinquennial mean (3·23). This increased incidence was borne by the districts of the Brahmaputra Valley, where the deaths recorded were more than double those of the previous year, whilst in Sylhet and Cachar they were fewer by nearly one-half. The districts which suffered most were Lakhimpur, Sibsagar, Darrang, and Goalpara. In regard to seasonal prevalence, it may be noted that whilst in 1887 the disease was most prevalent in the Brahmaputra Valley in January, and again in May to June, and in the Surma Valley in April to May, and again in December, in 1888 the disease reached its highest prevalence in the Brahmaputra Valley in the second quarter of the year (January showing the smallest monthly mortality), and in the Surma Valley in January with a recrudescence in December.

The health of the immigrant coolies was very seriously affected by the prevalence of epidemic cholera. Before proceeding, however, to details in this respect it may be noted that there was a considerable increase in the numbers imported. In 1888 33,317 adult coolies of all classes were imported against 29,090 in the preceding year, or an increase of 14·5 per cent. In addition to these there were 12,976 children

(*i.e.*, under 16 years of age) against 7,373, or an increase of 75·9 per cent. There was thus a grand total of 46,293 against 36,463, or an increase of 26·9 per cent., chiefly contributed by the very large proportion of children. Of this grand total 15,454 (against 10,436 in 1887) went to the Surma Valley, and 30,839 (against 26,027) to the Assam Valley. The latter enter Assam by Dhubri, either by the Kaunia-Jatrapur route, or by the river route from Goalundo, the great majority going by the former. Many of these coolies had to pass through a cholera-stricken region on their way through Bengal, where cholera prevailed epidemically in February to April. And in Assam too, as has been noted above, the disease was in unusual activity. Of the 31,294 coolies who started from recruiting districts for Dhubri, 21 died of cholera *en route*. At Dhubri itself cholera was epidemic in February and March, abating in April. The mortality among the 31,217 coolies who arrived in Dhubri, with a view to proceeding up the river, was very great, and is shown below :—

	Deaths.		
	Cholera.	Other causes.	Total.
At Dhubri	224	15	239
Dhubri to Dibrugarh	150	21	171
At ports of debarkation—			
Gauhati	144	4	148
Tezpur	76	2	78
Silghat	17	2	19
Dhansirimukh	8	1	9
Kokilamukh	55	14	69
Disangmukh	15	5	20
Nigriting	9	1	10
Dibrugarh	73	2	75
	771	67	838

Owing to this severe mortality from cholera, vigorous steps were taken both by the Bengal Government and by the Assam Administration to prevent a recurrence of it. The Lieutenant-Governor of Bengal issued the following orders :—

A cholera shed and place of inspection for coolies going to Assam, with the necessary establishment required for the proper treatment and care of the sick, was last year established at Kurigram, and the agency sanctioned for medical inspection at Mugra was at the same time transferred to Naihati, emigrants having ceased to break the journey at the former place. Arrangements were also made for the proper treatment of emigrants during the transit by rail, and for reporting by telegram to the Emigration authorities at Dhubri all cases of cholera occurring along the line of railway and at Goalundo. The Commissioners of the Chota-Nagpur and Burdwan divisions were further instructed, pending the contemplated amendment of the law, to take such executive measures as they could adopt with the co-operation of municipalities to mitigate the sanitary abuses brought to light by the inspection of the depôts in both divisions by the Sanitary Commissioner for Bengal. These orders are now repeated; and, in addition, the Lieutenant-Governor desires that the Sanitary Commissioner or the Superintendent of Emigration, as they may agree between themselves, in conjunction with a magistrate to be deputed for the purpose by the district magistrate, should inspect the private depôts at Raneegunge, and indicate to the owners any sanitary improvements which the inspection may show to be urgently necessary. It is hoped that such requisitions will be obeyed; but, if they are not, it will probably be necessary to take further steps under the municipal law, or by stopping emigration from infected areas. The depôts at Calcutta should be similarly inspected in communication with the Commissioner of Police. The municipality will be requested to ensure the due disposal at Raneegunge of the bodies of coolies dying at the depôts; cremation need not be insisted on, but all interments should be duly performed. The Superintendent of Inland Emigration will also be instructed to open a temporary cholera hospital at Raneegunge for infected coolies on a plan which he has prepared. In the event of an outbreak of cholera a medical officer will be deputed to the Sealdah station and another to the Raneegunge station to examine emigrants, and in communication with the railway authorities to prevent those infected from starting. The depôt from which an infected coolie comes should be ascertained in each case with a view to the adoption of precautionary measures.

The increased expenditure involved in these arrangements should be borne by the Inland Labour Transport Fund.

The measures taken by the Chief Commissioner of Assam were as follows, as described in the Annual Report on Labour Immigration into Assam for the year 1888. In consequence of the outbreak, the Bengal Government consented, with the previous sanction of the Governor-General in Council, to prohibit emigration as a temporary measure from certain parts of the Lower Provinces where cholera was very prevalent, and various precautionary measures were adopted in Assam in regard to the licensing of vessels, and the provision at the depôts of such additional accommodation as was necessary for the proper care of infected batches of coolies. It may be added that, after the epidemic subsided, the entire question of the procedure to be followed on the occurrence of an outbreak of cholera amongst the immigrants was carefully reviewed by the Chief Commissioner, with the result that extended power was given to the embarkation agent at Dhubri, with the view of enabling that officer to reduce on such an emergency the number of passengers which the steamers are ordinarily authorised to carry, and further, if the circumstances should justify such a course, to refuse the grant of a license, or temporarily to suspend the license, if granted, in the case of any particular steamer on board of which cholera may have appeared to a serious extent, and which the civil surgeon may believe to have become infected, until the necessary remedial measures have been adopted. It may be explained that there is no reason to fear these arrangements leading to a block of immigrants at Dhubri, because vessels which do not ordinarily carry immigrants are always available, or could always at once be made available, in the event of the accommodation on board the ordinary immigrant vessels running short, owing to the number of passengers which they are authorised to carry being restricted, or to the licenses of some of them being suspended. Measures have also been taken to secure the prompt reporting of any such outbreak and the immediate communication of the fact to the various magistrates concerned, with a view to such arrangements being made at the several depôts for additional accommodation, medical comforts, temporary establishment or otherwise, as may appear to be called for by the circumstances. Lastly, an important change has been made, whereby, on the occurrence of a serious outbreak of cholera, it is now open to managers to make arrangements for the immediate transport of coolies from the depôts to the gardens on the condition that they agree to make arrangements in accordance with certain rules which have been prescribed by the Chief Commissioner, in consultation with the Deputy Surgeon-General, for the purpose of providing for the segregation of the coolies, both in transit to the gardens and on arrival at their destination. The Chief Commissioner sincerely trusts that the measures which have thus been taken will have some appreciable effect at all events in reducing the mortality on any future occasion if it should unhappily arise.

Cholera in the North-Western Provinces and Oudh was less prevalent than usual: the total mortality was 0·42 per 1,000 against 4·54 in 1887, and 1·57, the quinquennial mean. In almost all districts where it prevailed epidemically in 1887 the disease died out, and in January 1888 only a few sporadic deaths were recorded in them. But, taking the province as a whole, the deaths increased as the year progressed, reaching a maximum in May and June, declining thereafter gradually to the end of the year, exhibiting a temporary recrudescence in some of the Oudh districts in October. Four districts enjoyed complete immunity from the disease, in 25 others sporadic cases occurred, the deaths recorded having ranged from 1 to 25; in three, deaths varied from 61 to 88; and in the remaining 17, the extremes were 268 and 2,933. The districts which suffered most were Bahraich, Basti, Gonda, Benares, Fyzabad, and Kheri. Thus the brunt of the outbreak fell upon the Sub-Himalayan districts. Only about 2 per cent. of the villages of the province returned deaths from this cause against 17 per cent. in the preceding year.

In the Punjab, cholera was more prevalent than in 1887, the death-rate having been 0·79 as compared with 0·47 per 1,000; and both these ratios exceed the quinquennial mean, which is 0·12 per 1,000. In January no death from this cause was recorded throughout the province; in the next three months a few sporadic cases occurred; in May it began to prevail with some virulence in the districts of Umballa, Jhelum, and Shahpur; but it was not until June that it became more widely spread. During the succeeding five months it continued to prevail with more or less severity; but in the last month of the year it had almost died out, only a few fatal cases having been reported from Dera Ghazi Khan, Bannu, and Kohat. The epidemic was confined mostly to the northern and western districts of the province. In 10 districts no

deaths were recorded throughout the year, in five only a few sporadic deaths, and in the remaining 16 the deaths ranged from 50 to 3,924 (or 9·31 per 1,000 of population) in Shahpur. In its epidemic form the disease appears to have started from Shahpur, but the cause of its origin there is uncertain; by some it was attributed to introduction from Kashmir, but, as the Sanitary Commissioner observes, "had the disease come from Jammu, it is strange that the Sialkot and Gujrat districts " were not first attacked, lying as they do between Kashmir territory and Shahpur." The Sanitary Commissioner thinks the disease spread into Shahpur from the frontier direction. "A curious feature with regard to the epidemic as it occurred this year," writes the Sanitary Commissioner, "was the exemption of the chief towns; con- " sidering the large population in them, the slight incidence of the disease in the " 15 which were attacked is very remarkable, and it would seem to indicate that their " sanitary condition is better than formerly."

The Central Provinces enjoyed considerable immunity from the disease, having suffered a mortality of only 0·10 per 1,000 against 1·43 in the previous year, and 1·53, the mean of the preceding five years. The province was practically free from the disease in the first and last quarters of the year, only one solitary death having been reported in the Bilaspur district in March, and four in Bhandara in December. In April one death was reported from each of the Seoni and Nagpur districts; but in Hoshangabad the disease broke out with some severity, and becoming epidemic in May and June, died out in July. Epidemics on a smaller scale appeared also in Narsingpur, Nima, Wardha, and Chanda, but in these the deaths varied from 15 in the first to 54 in the last district.

The death-rate in Berar from cholera was 0·1 against 5·5 in 1887, and 3·5 per 1,000, the last quinquennial average. The province, therefore, enjoyed unusual immunity. In continuation of the severe epidemic of 1887, a few cases occurred in the Wun, Basim, and Akola districts in January, but the disease soon died out and there were no cases during the following four months. In June one death was reported in Akola, in July seven deaths in Amraoti, Akola, and Buldana, but in August it became epidemic in most districts, Ellichpur alone enjoying complete immunity throughout the year. The largest number of deaths occurred in September, after which the disease gradually subsided. The Sanitary Commissioner observes that the highest cholera prevalence coincides with years of highest average rainfall and *vice versâ*. He writes:—"What- " ever were the influences, however, which kept cholera in abeyance, it certainly was " not due to a better sanitary condition of villages generally or any improvement in " their filthy surroundings."

In the Bombay Presidency cholera was more prevalent than usual, having given rise to a death-rate of 2·22 per 1,000 against 1·56 in the previous year, and 1·34, the average of the preceding five years. The epidemic of the preceding year gradually declined until February of 1888, when it reached its lowest ebb, but thereafter it began suddenly to revive with increased intensity, reaching its maximum in June. It then declined again, but in the last month of the year it was still giving rise to considerable mortality in Dharwar, Poona, Thana, and Belgaum. The districts which suffered most from it in 1888 were Surat, Broach, Thana, and Kolaba. Although the disease was present in Sind, it did not travel upwards beyond Hyderabad, where its incidence was slight. In the city of Bombay 372 deaths occurred, equivalent to 0·47 per 1,000 of population.

In the Madras Presidency also cholera was unusually prevalent, giving rise to a death-rate of 2·1 per 1,000 against 1·01 in 1887, and 1·5, the average of the previous quinquennium. The epidemic of the preceding year, which broke out with renewed energy towards the end of that year, reached its climax in January 1888. It thereafter subsided gradually until May; but in June it became revitalised, and after prevailing with severity to the end of August, again declined till the end of November, when it suddenly commenced again to prevail for the rest of the year. Most of the districts of the eastern coast and Malabar on the western suffered severely from it during the year. The districts of Tanjore and Tinnevelly suffered prominently. The Sanitary Commissioner observes that the disease in this Presidency exhibits cyclical development in six years. Thus the years 1868, 1874, 1880, and 1886 were years of minimum prevalence, and if the series is maintained the epidemic just described will gradually fall to its lowest ebb in 1892. In the city of Madras 521 deaths from cholera were registered, equivalent to 1·3 per 1,000 of population, against 471 deaths (1·2 per 1,000) in 1887.

As already noted, Burma suffered very severely. The recorded death-rate was 4·37 per 1,000 against 0·73 in 1887, and 1·21, the average of the preceding five years. The number of deaths returned (15,982) was the highest recorded since 1872. The disease showed signs of increase towards the end of 1887, and gave rise to increased deaths as the following year advanced, until the mortality reached its maximum in July and August. After this it declined, but exhibited another slight increase in December. All the districts of the Irrawaddy division, but especially Thayetmyo and the districts of Tharawaddy and Prome in the Pegu division, suffered most.

In the town of Rangoon 120 deaths from cholera were recorded, equivalent to 0·89 per 1,000 of population.

The following is a brief review of the circumstances attending outbreaks among troops and prisoners, as reported by the different medical officers, set forth under the same headings as in former years.

Among European troops 18 communities are reported to have been attacked; among Native troops 50; and among jails 37 communities; making in all 105 communities. Among European troops the most severely attacked communities were located in Rawal Pindi (61 cases, including 2 natives), Murree (55 cases, including 1 native), and Gharial (29 cases, including 8 natives). Among Native troops the communities most severely attacked were the 5th Punjab Infantry at Kohat, 49 cases; the 1st Sikh Infantry at Kohat, 14 cases; the troops in Surat, 26 cases. In the case of 22 Native troop communities only a single case occurred. Among jails 37 communities were attacked, in 8 of which a single case occurred, and in 6 only 2 cases. The communities most severely attacked were the jails at Rajshahye, 68 cases; Rawal Pindi, 66 cases; Lahore central jail, 61 cases; Moulmein, 50 cases; Toungoo, 47 cases; Chinawan, 36 cases; Benares central jail, 32 cases; Rungapore, 29 cases; Alipore, 28 cases; Bassein, 25 cases; and Pagan, 22 cases.

The usual antecedent unfavourable conditions are reported to have attended the first seizures in communities. Thus among European troops excessive beer-drinking, the eating of tinned or bad food, getting heated and wetted at the range are mentioned. Among Native troops 2 first cases occurred among men in hospital under treatment for other complaints. Eleven such cases occurred among men marching or travelling; in 2 cases indiscretion in eating and drinking; in other cases the men had been unduly exposed to the sun. In 22 cases no unusual antecedent conditions existed. Among prisoners the following may be quoted: In 3 cases there was a history of antecedent physical exhaustion, *e.g.*, in the 2 solitary cases which occurred in the Kishengunge sub-jail, and in the Tipperah intermediate jail and in the first of a series of cases in the Toungoo jail. In the first of these cases the prisoner came to the sub-jail from a distance of 13 miles. from a part, however, in which cholera was very prevalent. In the second case the prisoner was in course of transfer from Dacca during the 11th to 14th April, and was attacked on the 15th. In the third case the man was transferred from Myingyan, and was attacked three days later; the disease was at the time prevalent both in Myingyan and in Toungoo. In 5 instances the first men attacked were in hospital suffering from various causes (chicken-pox, ague, dysentery, and abrasion). The man who was suffering from chicken-pox and who was attacked with cholera was the first of a series of cases in the Alipore jail. One man suffering from ague was the first of a series in Rajshahye. In the great majority of cases no antecedent unfavourable conditions existed.

Among European troops diarrhœa was prevalent in 5 communities, slightly prevalent in 2, and not prevalent in 11. Among Native troops there was no diarrhœa in 40, some in 6, and a prevalence in 4. Among jails diarrhœa was apparently prevalent in 12, slightly prevalent in 13, and not prevalent in 12. In all the jails mentioned above in which epidemics occurred the disease was prevalent, except in Rawal Pindi and Toungoo (but dyspepsia was prevalent in the former and dysentery in the latter). In Bassein and Pagan, though present, it was slight. In Moulmein there was no diarrhœa before the outbreak of the epidemic, but it became prevalent during the epidemic.

For European troops we have complete data in the case of 14 communities. These occupied 424 buildings, of which 69 furnished cases, or 16·2 per cent. In Rawal Pindi the ratio was 35·7; in Murree 56·1; and in Gharial it is not stated. In the case of Native troops we have data for 21 communities. Among these 2,497 buildings were occupied, and 58 furnished cases, equivalent to 2·3 per cent. Native troops

occupy huts. In the case of jails, we have of course a large number of men within as small an area as is compitable with sanitary laws. We have data in the case of 34 communities. In all 420 buildings were occupied, and of these 167 furnished cases, or 39·76 per cent. In the three jails in which over 50 cases occurred, the proportion varied from 33·3 in Rawal Pindi to 78·9 in Lahore. The conditions among these three classes of people vary so greatly that little information is gained by bringing them all together; but it may be noted that in all 3,341 buildings were occupied, of which 294 furnished cases, or 8·8 per cent.

There is nothing unusual to report under meteorological conditions attending outbreaks. All varieties of climate are noted to have accompanied outbreaks.

No well-established casual connexion between those attacked and others has been reported. In the case of 14 communities of Native troops attacked, either the regiment passed recently through affected areas or the individuals attacked had done so in rejoining their regiments. Among prisoners it may be noted that in one case the man attacked was evidently admitted in the early stage of attack, as 12 hours later he developed typical symptoms of the disease (Presidency jail, Calcutta). At Rungpore the medical officer thinks the disease was introduced with paddy (rice) brought through an affected area. At Mozufferpore the disease was attributed to the water. At Lahore 30 cases of the 61 which occurred there came from a convalescent gang who were all receiving milk. In the Pagan jail the disease is said to have been introduced by a gang of convicts who came from Ponk, where cholera afterwards broke out; the first two cases which occurred in the jail were in the persons of two of this gang.

Among European troops, of 356 attendants on 180 cases, 2 were attacked, or 0·56 per cent. Of the latter one was an assistant apothecary and the other a comrade in attendance. Among Native troops there were 698 attendants on 183 cases, and 14 were attacked, equivalent to 2 per cent. At Kohat, where the disease was prevalent, of 111 attendants on 12 sick of the 4th Punjab Infantry, three contracted the disease (one medical officer, one orderly, and one *kahar*). At the same place in another regiment, Wing, 2nd Punjab Cavalry, and 1st Sikh Infantry, of 112 attendants on 23 sick, 3 got the disease (one *kahar*, one *bunniah*, and one other not distinctly specified). Still another regiment in Kohat (5th Punjab Infantry) recorded 111 attendants on 49 sick, of whom 2 got the disease. The attack of these 8 attendants at Kohat among communities suffering epidemically cannot reasonably be attributed to such attendance. The total number of sick attendants in Kohat was 333, of whom 8 contracted the disease, or 2·4 per cent. But for the garrison of Kohat, including 1,924 men, there were 50 cases of cholera, equivalent to a percentage of cases to strength of 2·6. Of the attendants attacked elsewhere than in Kohat one was a sick attendant and performed all the duties of a nurse; another at another station was similarly attacked; two men of 14 who attended on the sick of one community at Edwardesabad were attacked and died; one (a soldier) of these was one of a party of seven who came from Kohat, and who are supposed to have introduced the disease; the other was a *kahar* on duty at the cholera hospital. It must be observed that there were three other affected communities in Edwardesabad, among the sick attendants of whom no one contracted the disease. At this station there were in all 33 attendants on the sick, of whom 2 contracted the disease, or 6 per cent., whilst the percentage of attacks to average strength of the garrison was only 0·5. Coming next to jail communities, we find that, of 449 attendants who came in contact with 586 cases, 18 were attacked, or 4 per cent. Unusually large numbers were attacked in Rungpore and Toungoo, but in both places cholera was prevalent both within and without the jail walls. In Rungpore, of 32 attendants 7 were attacked, or 21·8 per cent.; in Toungoo of 16 attendants 4 were attacked, or 25 per cent. In Rungpore the percentage of attacks to average strength of prisoners was 38·5, and in Toungoo 10·5. In the remaining jails where attendants were attacked the figures are as follows:—

Alipore	28 cases,	33 attendants,	*1 attacked	= 3·0 per cent.
Rajshahye	68 „	11 „	2 „	= 18·1 „
Lahore	61 „	21 „	1 „	= 4·7 „
Chinawan	36 „	31 „	*1 „	= 3·2 „
Rawal Pindi	66 „	12 „	1 „	= 8·3 „
Moulmein	50 „	13 „	*1 „	= 7·6 „

Those marked with an asterisk were sweepers who removed excreta.

Bringing all these cases together, we get the following result:—

Communities.	Number of cases of Cholera treated.	Medical Officers, Hospital Assistants, and other Attendants on Cholera Cases.		Percentage of Attendants attacked.
		Number.	Number of these attacked.	
European troops	180	356	2	0·56
Native troops	183	698	14	2·00
Jails	586	449	18	4·00
Total	949	1,503	34	2·26

The total result is that 2·26 per cent. of attendants were attacked, a larger proportion than that of the preceding year, when 1·7 per cent. were attacked. But in the preceding year 2,318 persons attended on 732 sick, and 39 contracted the disease.

The drainage was reported to be imperfect at Dum-Dum; the conservancy arrangements were not satisfactory at Chaubattia; the water-supply and surroundings were bad and the barracks overcrowded at Murree; the water was open to contamination in Gharial. These are some of the defects complained of among European troops, and the same is repeated in a few cases among Native troops. Among jails the following may be noted: The drainage was bad outside the jail at Burdwan; the water-supply was noted to be bad or suspicious in 10 jails; overcrowding existed in 6, and especially in Minbu. At Moulmein the jail site is bad; the water-supply is said to be contaminated from the nearness of graveyards; while the high walls which encompass the jail stand in too close proximity to the dormitories.

As usual, the effect of movement was, in the great majority of cases, extremely beneficial. Among European troops, in 12 cases movement into camp was made; in 7 cases the disease was immediately arrested; in another, a single case occurred after movement. In Rawal Pindi the affected community was broken up into five groups; the *first* had no other cases; the *second* had 6 more cases after the first move, and 3 more after the second move, when the disease subsided; the *third* had one more case; the *fourth* had one more case; the *fifth* had 7 more cases after the first two moves, but no more thereafter. At Peshawar an attacked community had 3 cases after the first two moves, and no more thereafter. At Murree the men were divided into five groups; the first, second, fourth, and fifth groups had no more cases after moving, but the third group had 6 more cases during the first two moves. At Gharial two groups were formed, and of these one had no other cases and the other had 1 case after the first move.

Among Native troops moves were made by 20 attacked communities; 14 of these were immediately freed of the disease; three had only 1 more case after movement. In the case of the 5th Punjab Infantry at Kohat, which was severely attacked, the regiment was broken up into eight groups; in three of these, 1 more case occurred; in two, 2 more; and in three, no more. In Surat three groups were formed; the *first* had 4 cases after the first move, 2 after the second, 1 after the third, and no more thereafter; the *second* had 2 after the first move; the *third* had no case after movement.

Among prisoners 17 communities moved into camp. In six no further cases occurred; in four only 1 case occurred; and in one, 2 more cases occurred. Movement was less successful in the following: At Lahore two groups were formed, they each made only one movement; in one, 8 more cases occurred, and in the other, 4 more. At Chinawan two groups were similarly formed, and each made a single move; in one, 2 more cases occurred, and in the other, 10 more. At Rawal Pindi 11 groups were formed; in 6, no more cases occurred; in one, 20 more; in another, 15; in another, 4; and in another, 1; one move only was made by each group. At Bassein five groups were formed, and 8 more cases occurred. At Moulmein five groups were formed; the *first* had 10 more cases after the first move, 2 more after the second, and 1 more after the third; the *second* had no more cases; the *third* and *fourth* had no more; the *fifth* had 2 more after the first move. At Pagan they had 9 more cases after the first move, and no more after a second move.

A small epidemic of diarrhœa was reported among the men of the 2nd Royal Sussex Regiment at Camp Gharial, near Murree. It is interesting in having been contemporaneous with an epidemic of cholera. There were in all 12 cases admitted between the 4th and 28th August—eight privates, one officer, one boy, one child, and one woman. Occurring, as it did, while cholera was epidemic, some doubt as to its nature was naturally experienced; but the symptoms were so mild that they were returned as cases of epidemic diarrhœa. The men were at the time of outbreak all in camp, and all the cases could be traced to errors of diet. The monsoon was in full force at the time with light winds. There were similar cases in the Murree Bazar at the time. The water-supply was not good, being open to contamination? In all cases there was purging, but in no case collapse, suppression of urine, cramps or secondary fever, and all recovered. The officer who was attacked subsequently and in the course of the disease developed cholera. In all, 32 individuals attended upon these 12 cases, and none of them contracted the disease.

Small-pox.

The disease was considerably more prevalent than in the previous year, having given rise to 93,556 deaths against 65,755. The increase was shared in by all provinces, with the exception of Bombay and the small provinces of Mysore and Coorg. The increased deaths in those provinces showing an increase were most severely participated in, with reference to population, by Central Provinces, North-Western Provinces, and Berar, in this order Punjab, Bengal, and Madras participated least. For all provinces taken together, June was the month of highest mortality, but the season of maximum deaths varied naturally with geographical situation. Thus, in the Madras Presidency, the season of highest prevalence was March, and, in the Bombay Presidency, April.

Fevers.

The total number of deaths from fevers was 3,371,487, being considerably less than that of the preceding year (3,581,623), and appreciably less than that of 1886, which was 3,470,754. This diminished mortality was due to a smaller death-rate in the following provinces, beginning with that in which the decrease was greatest as compared with the preceding year. Berar (6·9 per 1,000 less), Punjab (3·62 less), North-Western Provinces (1·87 less), Madras (1·3 less), Central Provinces (1·26 less), Mysore (1·24 less), Bombay (0·26 less), and Coorg (0·09 less). In Bengal, Assam, and Lower Burma fevers gave rise to larger mortality ratios than in the previous year.

It is difficult to decide whether the increased ratio of mortality in Bengal was due really to greater prevalence, or to improved registration. Probably both combined to raise the ratio. Fevers, as usual, were the chief factor in the total death-rate from all causes. More than 72 per cent. of the total deaths were due to them. Deaths were recorded in all circles of the province, and in about 70 per cent. of villages. The districts of the Rajshahye division yielded the highest death-rates, and those of the Orissa division the lowest. The largest number of deaths from this cause in any one month occurred in December, and the smallest in June. The death-rate in urban circles was 10·30 against 14·63, the decennial average, and in rural circles 16·76 against 13·57. This great difference, however, the Sanitary Commissioner reports, must be attributed to defective registration in towns.

In the North-Western Provinces the mortality fell from 25·76 per 1,000 in 1887 to 23·89. This diminished mortality is noteworthy, as in nearly all districts the rainfall of the year was in excess of the average. Increased moisture is usually attended with increased mortality from fevers. The Sanitary Commissioner writes:—"Excess of moisture in the soil, however caused, is productive of malarial diseases; it matters little whether this excess is the consequence of rainfall, inundation by rivers or irrigation by canals; and in each case the remedy is drainage. The deaths were widely diffused over the province, 83 per cent. of villages having recorded mortality. While the rural mortality was 23·80 per 1,000, that of towns was 25·04. October was the month of highest prevalence, and March the lowest."

Fevers in the Punjab gave rise to a death-rate of 20·16 per 1,000 against 23·78 in the previous year. The months of fever prevalence were September, October, November, and December, and the Sanitary Commissioner notes that it followed immediately upon the decline of the cholera prevalence. The districts which suffered most were Umballa, Ferozepore, Gurdaspur, and Amritsar, and those which suffered least

were Jhang, Hazara, and Shahpur districts, with small rainfall. Of villages, 87 per cent. returned deaths. The urban mortality was 19·22 per 1,000 against a rural mortality of 20·24.

Fevers, though less prevalent in Bombay Presidency than in the preceding year, accounted for no less than 304,449 deaths, or considerably more than one-half the total mortality of the presidency. The brunt of these diseases fell, as usual, on the collectorates composing the Eastern Gujarat district. Deaths were recorded in all registration circles, and in about 93 per cent. of villages. The rural mortality was 19·05 per 1,000, and the urban 14·46.

The death-rate from fevers in the Madras Presidency fell from 8·6 per 1,000 in the preceding year to 7·3 per 1,000. To some extent this was probably due to the deficient rainfall and dryness of the year. The only districts which suffered a greater mortality than in the previous year were Malabar and the Nilghiris. Of villages, 50 per cent. recorded deaths in the presidency as a whole. The districts which suffered most were Kurnool, Cuddapah, Nilghiris, and Ganjam, and those which suffered least Tanjore and Tinnevelly. January and December were the months of greatest mortality, and April and October of least. The rural mortality was 7·5, and the urban 5·3 per 1,000.

The mortality from fevers in Berar fell markedly from 18·3 per 1,000 in 1887 and 16·4, the average of the previous five years, to 11·4 per 1,000. Of villages, 61 per cent. recorded mortality, whilst in rural circles the mortality was 11·0, in towns it was 11·3 per 1,000. The districts of Wun, Akola, and Ellichpur suffered most, and Basim least. The last quarter of the year was the most unhealthy in this respect, while June and July were the most healthy months.

In the Central Provinces, fevers were, on the whole, less prevalent, not only as compared with the preceding year, but also as compared with the average of the previous five years. As in the preceding year, the highest and lowest ratios were returned by the Nimar and Sambalpur districts respectively. Nearly 80 per cent. of villages recorded deaths from this cause. The rural mortality was 18·47 per 1,000, the urban 12·33, and the province as a whole 17·94. The season of greatest prevalence was the last quarter of the year, while February and March were months of least mortality.

In Assam, fevers were more prevalent than in the preceding year, having given rise to a mortality of 15·87 per 1,000 against 14·38. In the Surma Valley not a single circle was free from it, and in the Brahmaputra Valley 411 of 537 circles recorded deaths from it. In the province, as a whole, 76 per cent. of villages recorded deaths, in the Surma Valley 88 per cent., and in the Brahmaputra Valley, 70 per cent. The rural mortality was 15·84 per 1,000 (12·46 in Surma Valley and 19·50 in Brahmaputra Valley), and the urban 17·09 (6·47 in the Surma Valley and 23·84 in the Brahmaputra Valley). The season of greatest mortality in the Surma Valley was July to September, and in the Brahmaputra Valley May to June. The districts recording highest mortality were Goalpara and Kamrup (Brahmaputra Valley), and the lowest (excluding hill districts, where registration is very imperfect) Cachar (Surma Valley) and Sibsagar (Brahmaputra Valley).

In Lower Burma fevers accounted for 36,391 deaths (9·96 per 1,000) which exceeds the number for any year since 1872. As in the preceding year, the highest death-rate was returned by the Arakan division. Most of the deaths occurred during the latter half of the year, the maximum numbers having been attained in July and August. Of the several divisions into which Burma is divided, the Irrawaddy division contributed the smallest proportion of deaths. The rural mortality was 9·80 per mille, and the urban 11·16. Of villages, 70 per cent. recorded deaths.

Bowel complaints. The total number of deaths from bowel complaints, 251,144, was considerably smaller than that of the preceding year, which was 290,548. The remarkable variation in the ratio of these diseases in Berar noted in the report for the previous year was repeated in 1888: whilst in 1886 it was 6·4 and in 1887 8·2, it fell in 1888 to 3·8. The ratios, as compared with 1887, fell in Bengal, North-Western Provinces, Punjab, Central Provinces, and Berar, and rose in the remaining.

Injuries. The deaths from injuries numbered, in India, 85,793 against 82,208 in 1887 and 87,469 in 1886. The increase was contributed to by all the forms of violent and accidental death. Suicides were more numerous in all provinces except Central Provinces and Coorg, but especially in the Madras Presidency as compared with 1887.

Wounds gave rise to fewer deaths in all provinces except Bengal, Assam, and Mysore; the numbers for Punjab are identical with those of the preceding year. Fatal accidents were more numerous in Bengal, Assam, North-Western Provinces, Punjab, Mysore, and Coorg than in 1887. Snake-bite gave rise to a larger number of deaths in all provinces except Bengal and Assam.

The deaths from all causes other than those above accounted for numbered 1,005,345. **All other causes.**

Vaccination.

On the whole greater energy was expended on this branch of sanitation than in the previous year. The total number of operations performed was greater in every province except Coorg than in the previous year. In the Punjab, Berar, Burma, Assam, Madras, and Bombay the average number of operations performed by each vaccinator was greater, and in Bengal, North-West Provinces, Central Provinces, and Coorg less. But the ratio of success attending primary operations was less in every province except in Bengal and Assam (in Berar it was the same as in the preceding year). In re-vaccinations six provinces recorded higher ratios of success. The cost of each successful vaccination was less in all provinces but Central Provinces, Assam, and Coorg (in Bengal it was the same as in the previous year). The proportion of population protected was greater in all provinces except Bengal and Coorg, and the percentage of annual estimated births (at 40 per 1,000 of population) successfully vaccinated was greater in all except Lower Burma, Assam, and Coorg.

During the year the area under vaccination in Bengal was extended so as to include 5,692,894 persons in excess of the population shown in the report of the previous year. In consequence the total number of operators was increased to 2,320 from 2,151. Most of these in both years were licensed men. The total number of operations performed by them was 1,758,354 against 1,639,694 in the preceding year. The former number includes 4,604 re-vaccinations. Of these operations 99·44 per cent. are reported to have been successful in primary cases and 36·94 in secondary, against 99·33 and 37·38 respectively in 1887. Only a comparatively small proportion of these results was verified, however, by inspecting agency, and the ratios must therefore be taken with reserve. The operations performed by vaccinators attached to municipalities and dispensaries also increased from 78,961 in the previous year to 87,815. In these operations success was claimed at 95·56 per cent. in primary cases and 62·89 in re-vaccinations. The average number vaccinated by each vaccinator of the special establishment was 758 against 762 in the preceding year. The average cost of each successful case was the same as in the previous year, namely, R. 0-1-6. The percentage of annual estimated births successfully vaccinated was 11·5 against 11·2 in the previous year.

The total number vaccinated in the North-Western Provinces and Oudh was 764,190 against 751,875 in the previous year, or an increase of 12,315. During the year, however, falsification of returns was discovered on an extensive scale, especially in the districts of the 1st circle, and the figures must therefore be taken with considerable reserve. This increase was confined to the 2nd circle comprising the Oudh districts. Of the total operations performed 743,140 were primary cases with success at the rate of 92·74 per cent., and 21,050 were re-vaccinations with success at 42·57 per cent. The fact that on an average only 15·14 per 1,000 of the population of these provinces were protected during the year shows that this part of India is still considerably behind the other provinces in this respect. The average number of vaccinators employed was 677 against 663 in the previous year, and each vaccinator performed 1,128 operations on an average against 1,134 in the preceding year. The average cost of each successful vaccination was R. 0-3-1 against R. 0-3-2 in the previous year. The percentage of annual estimated births successfully vaccinated was 17·9 against 17·6 in the previous year.

The total strength of the department in the Punjab was identical with that of the previous year. Nevertheless, there was a considerable increase in the number of operations performed, which rose from 680,742 to 942,295. Of the latter number, 931,142 were performed by the district staff, consisting of 659,906 primary cases with success at 95·17 per cent. against 95·25 in the previous year, and 271,236 re-vaccina-

tions with success at 52·14 per cent. The special staff performed 105,435 operations with success in primary cases at 97·51 per cent. and in re-vaccinations at 50·80 per cent. against 97·07 and 49·22 per cent. respectively in the preceding year. The proportion of population protected was 40·84 per 1,000 against 32·36 in the previous year. About one-ninth of the total operations were performed with animal lymph, which was favourably reported on by the Civil Surgeons of all districts where it was used, with the exception of the Civil Surgeon of Hazara, who writes "buffalo calf lymph is apt to produce great local inflammation." The average number of operations performed by each vaccinator was 3,267 against 2,347 in the previous year. The cost of each successful vaccination was R. 0-1-7 against R. 0-1-9 in the previous year. The percentage of annual estimated births successfully vaccinated was 59·4 against 59·1 in the preceding year.

During the year the working of the department in the Central Provinces was extended to nine additional zamindaries and four feudatory States, or, in other words, the population of the area under operation was 11,004,010 against 10,537,258 in the preceding year. To meet this the average number of vaccinators employed was raised from 234 to 247. The total operations amounted to 434,935 against 411,908 in the previous year, but the average number of operations performed by each vaccinator fell from 1,745 to 1,734. Of the total operations, 392,246 proved successful in primary cases and 20,472 in re-vaccinations, yielding percentages of success at 95·96 and 78·21 respectively against 96·08 and 73·99 in the previous year. It is satisfactory to note that there was a considerale increase in the number of primary operations performed on children under one year of age. The operations performed in the dispensaries were on the whole smaller in number and less successful than in the previous year. Animal vaccination was practised with apparent success in many districts, and in three buffalo calves were utilised. Each successful vaccination cost R. 0-1-11 against R. 0-1-10½ in the preceding year. The ratio of successful vaccination per 1,000 of population was 37·51 against 36·49, and of estimated births successfully vaccinated 46·8 against 42·4.

The total number of vaccinations performed in Berar was 105,602 throughout the province, including Melghat, against 97,158 in the preceding year. Of these, 96,458 were performed by the special establishment with success at 96·4 per cent. in primary cases and 38·7 in re-vaccinations; and 9,144 were done by dispensary establishments with success at 95·5 and 39·3 per cent. respectively in primary and secondary operations. Each vaccinator of the special establishment performed on an average 2,288 operations against 2,095 in the previous year. On the whole, 36·6 per 1,000 of population were protected against 35·2 in the preceding year. Since June 1887 animal lymph only has been used, and it has proved successful. The cost of each successful vaccination was R. 0-2-11 against R. 0-3-1 in the preceding year. The percentage of annual estimated births successfully vaccinated was 79·4 against 75·5 in the previous year.

The total number of operations performed in Lower Burma rose from 73,847 in the previous year to 92,914, and the average number performed by each vaccinator from 1,273 to 1,659. This increase was especially prominent in the Hanthawaddy and Toungoo districts. In the former, however, more than one-half the operations were secondary on adults, among whom the ratio of success was 55·75 per cent. Of the total operations, 73,249 were primary cases with success at 86·14 per cent. against 87·27 in the preceding year, and 19,665 re-vaccinations with success at 55·20 per cent. against 63·11 in the previous year. In Shweygin, Bassein, and Pegu, which together accounted for more than two-thirds of the total deaths of the province from small-pox, the work of vaccination was very indifferently carried on. In addition to the above operations 4,187 were performed by hospital assistants attached to dispensaries against 2,769 in the previous year; but in these the ratios of success were 75·51 and 38·39 in primary and secondary cases respectively. The total cost of each successful vaccination was R. 0-6-0 against R. 0-7-2 in the previous year. The proportion of population protected was 19·79 against 16·70; and the proportion of estimated births protected 10·0 against 11·1 in the preceding year.

During the year 16 men were added to the staff in Assam, and the total number of operations throughout the province, including tea gardens, increased from 132,349 in the previous year to 134,138. This increase was, however, due to greater exertion in only four districts, of which Sylhet and Goalpara were the most conspicuous. In the

remaining eight districts there was a marked decrease in the number of operations performed. In tea gardens also the total number of operations fell. The percentage of success obtained in primary cases was the same as in the preceding year, viz., 91·59, which is nearly equal to the average proportion of success verified by inspecting officers. In re-vaccinations the ratio was 80·73 against 79·08 in the previous year. Vaccination in the municipalities of Sylhet, Gauhati, and Dibrugarh was unsatisfactory, although the Compulsory Vaccination Act has been in force in them for some years. The matter is, however, engaging attention. In the districts of Nowgong and Darrang an extremely hostile feeling against vaccination prevails. The average number of operations performed by each vaccinator was 629 against 551 in the previous year, and the average cost of each successful vaccination R. 0-2-3⅔ against R. 0-1-10. The proportion of population protected was 25·38 per 1,000 against 24·01, and the estimated births protected 11·1 per cent. against 11·3 in the preceding year.

The establishment at Madras was increased by 19 hands. The total number of operations performed by the special establishment, including those carried on by medical subordinates attached to dispensaries, rose from 738,480 in the previous year to 809,417, due to a considerably larger number of primary operations performed, as the total number of re-vaccinations was less than that of the previous year. The average number vaccinated by each vaccinator of the special establishment was 986. Of primary vaccinations by the special establishment 95·7 per cent. were successful, and of re-vaccinations 72·1. The cost of each successful vaccination was R. 0-4-2. In dispensaries 18,827 persons were vaccinated with successes at the rates of 85·3 and 50·6 per cent. in primary and re-vaccinations respectively. The ratio of successful vaccinations per 1,000 of population was 24·4, and the percentage of annual estimated births successfully vaccinated was 13·3. Animal vaccination was conducted in 16 circles. The number of calves inoculated was 939, varying in age from one year to two months. The total cost was Rs. 3,347-9-11. With such lymph 42,445 persons were vaccinated with success at 94 per cent. The average cost of each such successful case was R. 0-1-4. In all 21 towns were under the provisions of the Compulsory Vaccination Act.

During the year there was an addition of one superintendent and 10 vaccinators to the staff of the Bombay Presidency, but the Sanitary Commissioner thinks that the establishment is still insufficient, and indeed 7,612 villages were not visited on this account. In all 942,768 operations were performed, of which 878,993 were successful. Of these the numbers of primary vaccinations and re-vaccinations performed by the special establishment were 887,378 and 48,296 respectively with successes at the rates of 95·13 and 62·54 per cent. These ratios are below those of the two preceding years. The dispensary staff performed 6,720 primary vaccinations and 374 re-vaccinations with successes at the rates of 89·81 and 60·70 per cent. respectively. The average number of operations performed by each vaccinator was 1,883 against 1,852 in the previous year, and each successful vaccination cost R. 0-5-0 against R. 0-5-1. The proportion of population protected was 34·07 per 1,000 against 33·54 in the preceding year, and the estimated births protected were 58·0 per cent. against 57·0.

There was a decrease in the number of operations performed in Coorg, but the proportion of successful vaccinations was greater. In all 6,928 primary vaccinations were performed by the special establishment with success at 94·28 per cent., and 217 re-vaccinations with success at 79·92 per cent. The number of vaccinations done by each vaccinator was 714 on an average, and each successful case cost R. 0-5-0. The proportion of population protected was 37·60 per 1,000, and the estimated births protected 8·5 per cent.

Sanitary Works, Military.

In all Rs. 56,13,362 was spent on the military sanitary works undertaken or executed during the year 1888–89 mainly for securing the health and comfort of the European troops serving in India. No detailed information has yet been received regarding the works. The data will therefore be published in the next report.

Civil Sanitary Works.

Under the head of important sanitary works there is nothing to record in Bengal excepting the completion of the Dinagepore drainage scheme at a cost of Rs. 23,884.

The total expenditure of the municipalities on sanitation amounted to Rs. 16,81,703, or about 51 per cent. of their income. In addition to these Rs. 5,16,374 were spent in the interior of the districts in providing bridges and culverts and constructing or repairing roads, drainage channels, tanks, wells, &c., &c., and Rs. 2,37,661 was laid out by private individuals on works of public utility, consisting chiefly of roads, bridges, tanks, and wells.

In regard to village sanitation nothing has yet been done in the North-Western Provinces and Oudh, but since the close of the year a Sanitary Board has been nominated and the members are at present engaged in devising some practical scheme of operations for the sanitation of towns and the drainage of rural areas. Some of the important sanitary works executed or undertaken in the municipalities of the province were as follows: At Dehra a supply of pure water was brought into the city from the Nala-Pani spring, and about Rs. 12,000 were expended on the waterworks and reservoirs. At Mussoorie the revised conservancy scheme was completed at a cost of Rs. 7,132, and the new waterworks project cost Rs. 4,000. At Allahabad the Dara nala and Bakhtiaru drains were completed, and a scheme for the removal of the city filth to the other side of the Jumna by means of Shone's ejectors is in preparation. Plans and estimates for the new waterworks, at an outlay of Rs. 15,40,000, were submitted to Government for sanction. At Benares a scheme of waterworks and sewers has been elaborated, which has been estimated to cost about 40 lakhs. At Gorakhpur Rs. 1,213 were spent in draining the Ramgarh Tal. At Lucknow large sums were spent on drainage, and cleaning, deepening, and repairing of wells; an artesian well is also being bored, and has now reached a depth of 676 feet. At Sultanpur the main drain of the town towards the Gumti was in construction. At Fyzabad a scheme for supply of pure water to the city was under consideration. Besides these, a good deal was spent by almost all the municipalities of the province on conservancy, drains, wells, bridges, roads, and other minor sanitary works.

Some of the important sanitary works which have been completed or were in progress or under consideration in the Punjab during the year were as follows: The Khalilpur bund in Gurgaon and its subsidiary works were practically completed during the year. At Delhi Rs. 17,583 were spent on the construction and repair of drains; a conservancy tramway, at an estimated cost of Rs. 50,000, was about to be taken in hand; a drainage project for the city was also under consideration, and the waterworks scheme has been sanctioned at a cost of $10\frac{1}{4}$ to 11 lakhs of rupees. The extension of the Karnal city and suburban drains and the Paniput drainage works were in progress. A project for the water-supply of Umballa was under consideration. In Jullundur a scheme for the drainage of the town of Bungah was under consideration. The Ludhiana drainage scheme, at an estimated cost of Rs. 14,616, was in progress. At Mooltan drains were repaired at a cost of Rs. 34,539. In Lahore the Chouburji drain was made of masonry as far as the Meean Meer escape, at a cost of Rs. 4,200. At Amritsar the city ditch was being filled in, and Rs. 2,11,338 were expended on it during the year. The drainage scheme of Gujranwalla were in progress, and up to the end of 1888 Rs. 31,300 were spent on it. At Peshawar Rs. 13,059 were spent in the city in constructing some new drains, and a project for supplying the city with Bara water, at an estimated cost of Rs. 3,14,000, was about to be taken in hand. In Bannu two new wells at Edwardesabad and a masonry pavement at Isakhel, at an estimated cost of Rs. 19,910, were in course of completion. In all Rs. 9,53,303 were spent on sanitation by the Punjab municipalities during 1888.

No sanitary work of importance was accomplished in the Central Provinces during the year, but "in every district more or less was done to improve the sanitary condition of the large towns." During the year 185 new wells were constructed throughout the province. The proportion of income spent on sanitary works and vaccination by the different municipalities is not encouraging. The expenditure on conservancy arrangements varied from 1·39 per cent. of income in Betul to 33·77 per cent. in Damoh. Only 10 of the 19 municipalities spent anything on drainage, and in these the proportion ranged between 1·06 and 4·47 per cent. of income. On water-supply works no expenditure was incurred at Damoh; in the remaining municipalities the outlay on them varied from 0·13 per cent. in Narsinghpur to 18·12 in Jubbulpore. Only seven of the municipalities contributed towards vaccination, and in these the proportions varied from 0·01 per cent. to 1·51 only.

The following is a list of some of the important sanitary works executed by the Public Works Department and in progress in Berar during the year :—

	Cost.
	Rs.
Camp waterworks, Amraoti - - -	53,162
Repairing waterworks at Wadali tank and increasing its storage capacity as well as that of Kalapani tank, both in Amraoti - - - - - -	16,442
Extension of city waterworks, Amraoti - - -	26,548
Supplying water to new Gowlipoora, Amraoti - -	7,950
Drainage of Murtazapur town - - -	16,399
Bhir Dam, Chikalda - - - - -	83,130
Raising and extending the bund of Kootasa tank - -	12,343
Improving the old tank at Ookli Sookli - - -	1,721

No works of any magnitude were undertaken by the municipalities during the year, but a fair proportion of their income was spent on conservancy, drainage, water-supply, and other sanitary improvements in almost all of them. The total income of the municipalities amounted to Rs. 1,55,627, and out of this Rs. 89,198 (or, according to details separately given, Rs. 93,622), or 57·3 per cent., were expended for sanitary purposes. In the civil stations, non-municipal towns, and villages of the province, Rs. 1,05,476 were spent on sanitary improvements against Rs. 93,685 in 1887. Out of this 28 per cent. was expended on conservancy, 21 on drainage, 20 on water-supply, and 30 on other sanitary works. In August 1888 a sanitary survey was carried out of the towns of Badnera, Murtazapur, Koorum, and Chandur, and in September the survey of Karinja, Ellichpur, and Paratwadi was taken in hand.

No sanitary work of any magnitude was carried out in the province of Assam, but it is satisfactory to note that before the close of the year, in accordance with the orders of the Government of India, a Sanitary Board was established, which, it is hoped, will, with the co-operation of the Local Boards, succeed gradually, as funds become available, in introducing sanitary reforms of a generally useful and far-reaching character in the rural and urban areas of the province. Towards the end of the year instructions were issued to district officers for improving the sanitary condition of villages commencing with those lying near the headquarters, and their attention was specially directed to the provision and protection of sources of water-supply, the establishment and maintenance of a proper system of drainage, and the prohibition of the deposit of manure and other refuse in places where they might be a source of danger to the health of the neighbourhood. Some of the works executed or undertaken in the municipalities were as follows: At Sibsagar some Norton's tube wells have proved successful, and the feasibility of extending the use of such wells throughout the province is being inquired into. In Sylhet the water-supply scheme was in a fair way to be carried out. At Dibrugarh a drainage project for the town was under consideration; measures were also under consideration for removing dense overcrowding in a portion of Barpeta, and for properly draining the town and supplying sources of pure water for its population. In all the municipalities, stations, unions, and towns considerable portions of their income were spent on drainage, water-supply, conservancy, vaccination, and other sanitary requirements. The total amount expended was Rs. 79,476 against Rs. 74,366 in 1887, or about 55·37 per cent. of the actual income of the year.

The only important sanitary work in hand in Lower Burma was the sewerage scheme of the town of Rangoon, which was being vigorously pushed on by Messrs. Shone and Ault. Most of the municipalities spent a portion of their income on ordinary conservancy arrangements, drains, tanks, roads, &c., &c. Besides these, Rs. 16,513 was expended by the Public Works Department on water supply, drainage, latrines, urinals, burial grounds, and scavenging. Towards the close of the year a Provincial Sanitary Board was constituted in accordance with the orders of the Government of India. The members are at present engaged in ascertaining all particulars regarding the sanitation of rural areas and the resources available for carrying on improvements, and they are expected to submit shortly practical proposals for commencing actual work in those tracts. With regard to municipalities, the sanitary survey of nine of them will probably very soon be taken in hand at an estimated cost of Rs. 10,000 for each town.

Under civil sanitary works in Madras there is no work of any importance to record. The improvements carried out in the municipalities consisted of constructing or

repairing tanks and wells, latrines, drains, roads, dust-bins, markets, slaughter-houses, &c., &c. Out of a total allotment of Rs. 6,81,294 for 1888–89, the amount spent up to 31st December 1888 was Rs. 4,33,187. In addition to this Rs. 16,387 was assigned for vaccination. The works carried out in the local funds circles consisted chiefly of improvement in water-supply and village sites, and of construction and repair of drains, latrines, &c. Out of Rs. 4,85,357 sanctioned for 1888–89, only Rs. 2,61,862 were actually spent during the first nine months of the year. The Kurnool District Board deserves special mention for the steps it has taken to improve the conservancy of villages and to utilise the rubbish and filth of towns and villages for the purpose of manure.

The civil sanitary works in Bombay about which information has been furnished were all confined to municipalities. Conservancy arrangements were in force in all of them, and in most of them works such as construction or improvement of latrines, culverts, gutters, roads, wells, tanks, bridges, &c., were carried out. Some of the important sanitary works which were undertaken during the year or were in contemplation were as follows:—A scheme for the water-supply of Ahmedabad has been sanctioned, and will shortly be taken in hand. Here the municipality has voted Rs. 1,50,000 for drainage work and sewage farm. At Nadiad a project for the drainage of the city was under consideration. At Dakor a scheme has been prepared for surface drainage and metalling of the main roads at an estimated cost of Rs. 18,000. The "Dedargaon" waterworks scheme for Dhulia has been sanctioned. At Karachi the drainage scheme was under consideration.

There is little to record under the head of civil sanitary works in Coorg. In all Rs. 3,159–6–2 were spent in constructing or repairing wells, drains, &c., &c., by the Public Works Department and the municipalities combined against Rs. 2,620–0–4 in the preceding year. Towards the end of the year, however, a Sanitary Board was instituted in accordance with the orders of the Government of India, and it is hoped that the sanitary condition of population centres will be more carefully looked after.

General Remarks.

Health of the Haj pilgrims in 1888.

Vice-Consul Sheik Ata Mahammad submitted an interesting report on the Lazaret at Camaran for the pilgrim season 1888. The season extended from the 10th March to the 5th September, and during this time 20,924 pilgrims called at Camaran to undergo the quarantine imposed on them. Of these 13,913 arrived from India, but only 9,727 were of Indian nationality, the rest being Malays, Afghans, and Turkomans, Arabs, and Persians, who touched at or passed through India *en route*. The period of quarantine varied from five to ten days for all those above mentioned, 10 days for arrivals from India if no death from, or suspicious case of, cholera has occurred in the voyage, and five days for arrivals from Singapore, Java, &c. Of the 20,924 pilgrims 4,956 were paupers (4,145 coming from India, but possibly containing some not of Indian nationality). Among this large number of pilgrims only 34 deaths occurred (0·16 per cent.) during their stay at Camaran from various diseases as well as from debility and old age, from which latter there were 13 deaths. Of these total deaths, 23 occurred among Malays, 10 among Indians, and 1 among Afghans. There was not a single case of cholera amongst them at Camaran throughout the season, nor did any ship have any case of the disease on the voyage. The water supplied to the pilgrims was sufficient in quantity, but the water stored in the stone tanks (for 1,000 pilgrims for about a fortnight) is stated to be more brackish than it is when fresh from the wells. The huts are new, high, and well ventilated.

No detailed report on the subsequent sanitary history of these pilgrims has been received up to the date of this report being written, but information has been received that the season passed without any outbreak of cholera. There has been no outbreak of cholera in the Haj since 1883.

Cholera in Kashmir.

A severe epidemic of cholera visited Kashmir during the year, and the following notes of it are taken from a report submitted by Surgeon-Major Deane, Residency Surgeon. The epidemic was severe not only in the mortality it gave rise to, but also in the area it was spread over. The Resident reported that the people, especially in Srinagar, were thoroughly depressed, and that business of all kinds was at a standstill. The first case in Srinagar occurred on the 6th of April, and the last on the 22nd of July. The vast majority of the cases occurred between the 6th April and 6th June, 6,131 cases having been reported during that time with 2,927 deaths out

of 6,631 during the entire epidemic, with 3,078 deaths in all. The disease was said to have been introduced by the followers of His Highness the Maharajah from Jummu, where it prevailed in February and March. The Maharajah arrived in Srinagar on the 6th April. For the next 8 or 10 days frequent cases occurred amongst the troops near the palace, and then the disease spread rapidly through the city, no portion of it escaping. The disease extended also through the valley generally, and although it was worse in some places than in others, yet no place escaped wholly.

Much reliance cannot be placed on the accuracy of the statistics of the disease, but the figures given by the Residency Surgeon are as follows:—The total number of attacks for the whole valley was reported to be 15,659, and of these 9,610 died. Of these cases 6,631 occurred in Srinagar, with 3,078 deaths. No climatic condition had any marked effect on the disease; indeed, as the heat increased the disease decreased. The European visitors escaped almost entirely, only one case occurring amongst them, and that one recovered; but during the epidemic bowel disturbance was very prevalent among them, and the Residency Surgeon writes, "and I have no doubt that if it had not been checked in time it would have gone on to cholera."

Mahamari or hill plague in the Kumau District

The Deputy Sanitary Commissioner, 2nd Circle, North-Western Provinces (Surgeon-Major Thomson), submitted a short report on the outbreak of a small epidemic of mahamari or hill plague in the Kumaun Hills. He reports as follows:—"Information "having reached me of the prevalence of this disease in *puttee* Pungaon, I proceeded "to the spot on my arrival from the plains, and elicited the following facts from "the *putwari* and local native residents. The history of the outbreak appears to be "as follows:—

"On August 19th, 1887, a case occurred in village Dasauli, when one Gungna Patak "was attacked but recovered. On the 25th a fatal case occurred in the same village, "and another on the 31st. The disease continued in the locality all through the "following month. On September 18th a case occurred in the neighbouring village "of Lothal, the victim being a resident of Dasauli who had come to her relatives at "Lothal to be confined. A second case soon after occurred in the same house. Two "more died in the same house in October, and the dwelling was abandoned. Disease "continued through October in Dasauli, but died out altogether in November. "Again, however, on March 29th two fatal cases occurred in a neighbouring village "(Kouree), and on April 5th a woman died in Khitauli. Her husband also died on "the 8th of the same disease. On the same date a boy died in Lothal. This case "is interesting. The house in which former cases had occurred had stood for some "months empty, the owners living a short way off in 'chuppars.' But this boy "knew of the existence of 'goor' in the house, and was observed taking some from "the building. No others appear to have entered the house. A fatal case also "occurred in Singora two days before my arrival (May 9th).

"Although isolated cases have been reported from other villages, the brunt of the "attack was borne by this group of villages clustered together on the side of a hill "about 6,000 feet high. From my inquiries no doubt exists as to the nature of the "disease. It was *mahamari* 'gola rog' or 'phutkia' hill plague, or a severe type of "typhus fever, highly contagious, and bred and fostered by filth.

"On my arrival I directed that the villages should be cleaned up, and recommended "that every house in which cases had occurred should be disinfected, under definite "instructions, with sulphurous acid gas. These recommendations have been given "effect to by the Senior Assistant Commissioner. I found that the inhabitants of "Kouree and Khitauli had voluntarily abandoned their villages for the time. In "Dasauli, I am informed, the owner of the house in which the disease broke out was "urged by his fellow residents to burn his house. He, however, refused, locked it "up and went away to another village. Thereupon someone set fire to the house "during the night.

"Altogether 62 deaths appear to have occurred in this *puttee*, the large majority of "the victims being residents of Dasauli, where the disease broke out. Nearly all "those attacked died. Native opinion holds the grain to be at fault, and instances "the undoubted fact that previous to an outbreak rats and mice and even snakes are "found lying dead in numbers about the site, apparently poisoned. So well is this "known that in Garhwal I have seen a village evacuated by the people before a "human being was attacked. It is true that in this *puttee* the people, not having a "ready market for grain in good years, are in the habit of burying the surplus "in shallow pits below the floor of their dwellings. It is, however, to filth that I "have no difficulty in attributing the disease."

Animal vaccination.

During the year 1889 the subject of animal vaccination has engaged attention. Surgeon-Major A. Barclay submitted a report upon the present condition of animal vaccination in Europe, after having visited several large institutions in Europe, with detailed instructions for carrying out the latest improvements in this branch of sanitation. The report has been circulated to local Governments with a view to the improvement of existing methods, and to the extension of animal vaccination as far as is practicable in India.

Scientific memoirs.

The fifth part of Scientific Memoirs by Medical Officers of the Army of India is published concurrently with this Report. It contains the following articles :—

On Milk as a medium for choleraic Comma Bacilli.—Surgeon-Major D.D. Cunningham, M.B., F.R.S.

On the Pathological histology of Rhinoscleroma.—Surgeon-Major G. Bomford, M.D.

A list of Laccadive plants.—Surgeon David Proin, M.A., M.B.

On the Life-history of a Himalayan Gymnosporangium. (G. Cunninghamianum, Nov. Sp.)—Surgeon-Major A. Barclay, M.B.

On a Chrysomyxa on Rhododendron arboreum, Sm. (Chrysomyxa Himalense, Nov. Sp.)—Surgeon-Major A. Barclay, M.B.

On the Life-history of a Uredine on Rubia Cordifolia, Linn. (Puccina Collettiana, Nov. Sp.)—Surgeon-Major A. Barclay, M.B.

Dr. Cunningham's paper deals with the results obtained in a large number of experiments on the normal Schizomycete contents of average samples of milk in Calcutta, and on the behaviour of the fluid in its natural and sterilised conditions as a medium for choleraic Comma-bacilli. It was ascertained in the first place that, as might have been expected, the numbers of Schizomycete organisms present in the normal milk supply of the bazaars and European houses in Calcutta are very considerable, amounting, in many instances, to several hundred thousand to the cubic centimetre. The species normally furnishing this population are, however, few in number, those of most constant occurrence being a large micrococcus, a short, thick, oval Bacillus, and Bacillus subtilis. Connected with the presence of the two former organisms, rapid processes of development of an acid re-action and coagulation in the fluid normally manifest themselves. They are in many cases put an end to by simple boiling of the milk, which serves to destroy all the Schizomycete contents, save spores of Bacillus subtilis, which would seem to be constantly present, although in limited numbers only. The milk then remains fluid in many cases for a considerable period and unaltered in re-action, although processes of coagulation of a peculiar character do ultimately manifest themselves. One curious phenomenon is that the stratum of any stock of milk from which the samples experimented with are derived acts as a determinant of the absence or presence of rapid coagulation subsequent to boiling, although in all cases alike a complete destruction of all Schizomycete elements, apart from spores of Bacillus subtilis, appears to be secured. In regard to the behaviour of milk as a medium for choleraic Comma-bacilli, the experiments gave results generally agreeing with those published by Kitasato during the past year in the "Zeitschrift für Hygiene." Normal milk was found to be anything but a favourable medium for the Comma-bacilli, which rapidly succumb to the struggle for existence with the normal Schizomycete population of the fluid, and are completely destroyed by the acid changes in the latter connected with its presence. On the contrary, simply boiled milk and sterilised milk alike furnished conditions permitting of the continued existence and excessive multiplication of Comma-bacilli during periods of prolonged duration, the presence of Bacillus subtilis in boiled milk even in very great excess not serving to prevent the persistence and evolution of the other species, and the conditions present in sterilised milk apparently resembling those provided by any common favourable medium in which a struggle for existence is entirely absent. The data obtained from the entire series of experiments agree with those which were arrived at previously as the result of experiments on the behaviour of Comma-bacilli in soil and water in indicating that the bacilli are very fragile and feeble organisms, very ill-fitted to hold their own in the struggle for existence to which they are normally exposed, and therefore likely, under normal circumstances, to die out rapidly in any locality to which they may be introduced. The results also would appear to be well calculated to raise doubts in the minds of all who regard Comma-bacilli as the specific cause of cholera, in regard to the accuracy of explanations of outbreaks of the disease as due to the use of milk, unless in cases where very stringent proof of the actual presence of living choleraic constituents in the fluid at the time when it was in use has been furnished.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1888.

(Surgeon-Major J. A. Laing.)

General Population.

Vital statistics.

During the year 1888 there were 833,345 births (exclusive of European, Eurasian, and still-births) registered, giving a birth-rate of 29·9 per 1,000. The births are thus 16,206 less than the number registered in the previous year, but the birth-rate (29·9), with the exception of that for 1888 (30·4), is the highest on record.

The following table shows the number of births and deaths registered in each year from 1871 and their ratios per 1,000 of population:—

Years.	Population for which returns were received.	Births.	Birth-ratio per 1,000.	Deaths.	Death-ratio per 1,000.
1871	24,555,046	506,707	20·6	444,371	18·0
1872	30,147,779	543,325	18·02	501,482	16·6
1873	30,287,842	527,363	17·4	506,894	16·4
1874	30,360,221	569,631	18·7	516,848	17·0
1875	30,278,903	625,953	20·6	641,260	21·1
1876	29,157,056	619,748	21·2	680,384	23·3
1877	29,209,542	467,543	16·01	1,556,312	53·2
1878	29,127,205	341,388	11·7	810,921	27·8
1879	28,991,267	467,938	16·1	549,390	18·9
1880	28,778,097	641,769	22·3	454,101	15·7
1881	28,676,375	716,672	24·9	465,682	16·2
1882	28,887,111	743,777	25·7	470,700	16·2
1883	28,503,100	774,754	27·2	541,930	19·0
1884	28,151,952	810,102	28·8	650,335	23·1
1885	28,118,178	807,105	28·7	615,449	21·8
1886	28,043,538	837,077	29·8	553,927	19·7
1887	27,907,840	849,551	30·4	604,775	21·6
1888	27,852,474	833,345	29·9	597,015	21·4

The birth-rates were higher in six districts (Godávari, Kistna, Malabar, Nílgiris, Salem, and Vizagapatam) in 1888 than in 1887, but in all the others they were lower. The districts of Salem and Vizagapatam show the largest increase in 1888 over 1887 in the rate per 1,000, and Kurnool and Chingleput the greatest decrease. The highest birth-rates registered were 40·3 in Salem and 40·06 in the Bellary-Anantapur districts. Excluding the Nílgiris, the birth-rate was lowest in the Ganjam district (20·9), next to it Godávari (21·0), and then Vizagapatam (21·5). These three districts as mentioned in last year's report have for some years always returned the lowest birth-rates, and defective registration is doubtless the reason why the recorded birth-rates are so low. The birth-rates for Ganjam district have been steadily decreasing year by year since 1884. Vizagapatam and Godávari districts, however, show an improvement in the registration of births in 1888 when compared with that for 1887. In only two districts (Bellary-Anantapur and Salem) the birth-rate was above 40 per 1,000 of population, in nine it was over 30 and under 40 per 1,000, and in 10 under 30 per 1,000.

Of the births registered in 1888, 426,749 were males and 406,596 females. The birth-rate among males was 15·3 and among females 14·6 per 1,000 of population. Taking the presidency as a whole, there were 104·9 male births registered to every 100 female births. The ratio between male and female births registered in 1887 was 104·6 to 100, almost exactly the same as this year's ratio.

The urban birth-rate for the presidency was, as usual, smaller than the rural, the ratios per 1,000 of population being 27·0 and 29·8 respectively. In 1887 the urban birth-rate was 28·6 and the rural 30·4. In nine districts (Coimbatore, Ganjam, Godávari, Madura, Malabar, Nellore, Nílgiris, South Canara, and Vizagapatam) the birth-rates were higher in urban than in rural populations, the difference being most marked in the Coimbatore and Nílgiri districts. In the remaining 11 districts the birth-rates were higher in the rural than in the urban populations, the difference being most marked in the Chingleput and Trichinopoly districts.

There were 597,015 deaths registered during the year under report, *vide* table on preceding page. In the previous year 604,775 deaths, or 7,760 more than in 1888, were registered. The death-rate of the Presidency in 1888 (21·4 per 1,000) was lower than the rate for 1887 (21·6), but a little higher than the average rate for the five years 1883-87 (21·0). Of the total deaths registered, 308,296 occurred among males and 288,719 among females, the rate per 1,000 being 22·3 for males and 20·5 for females. The registered male is thus higher than the registered female death-rate, and is in accordance with the experience of former years. The excess of male over female deaths was most marked in the South Canara and Ganjam districts.

For every 100 females who died, 106·7 deaths among males were registered, but their proportions vary considerably in some districts.

In Godávari district	116·6	male deaths were recorded	for every 100	female deaths.
In Ganjam	do. 116·0	do.	do.	do.
In Vizagapatam	do. 114·9	do.	do.	do.

In only two districts—Madras and Tanjore—there was an excess of deaths among females over the deaths among males.

The mortality amongst infants under one year (21·5 per cent. on total deaths) and children above one year but under five (13·9) was as usual very high in comparison with other periods of life. The deaths in children under five years of age formed 35·4 per cent. of the total deaths, and, as has been pointed out, this high rate of mortality among children of tender years is a proof of local causes of insanitation throughout the Presidency. The period when fewest deaths occurred was in the age of above 10 and under 15, the rate being 6·3 per 1,000.

According to classes the recorded death-rates among Muhammadans was 23·1, among Hindus 21·4, among Native Christians 17·3, and among other classes 14·7. The death-rates are higher than those in 1887 for Muhammadans, Native Christians and other classes, but lower for Hindus. For Muhammadans the maximum rate (42·6 per 1,000) took place in Madras, and the minimum (10·6) in Vizagapatam. In 1887 these results were 44·2 and 12·4, and occurred in Madras and South Arcot. Amongst Hindus the maximum rate (37·6) was in Madras and the minimum 12·5 in Vizapagatam. In 1887 these results occurred in Madras (39·4) and Nílgiris (15·2). For Native Christians the maximum death-rate was 31·2 and took place in Madras, and the minimum 9·0 in North Arcot. In 1887 the results were 29·8 and 6·3, and occurred in Madras and Ganjam. In 10 districts, Anantapur and Bellary, Coimbatore, Ganjam, Madras, Malabar, North Arcot, Salem, South Arcot, South Canara, and Vizagapatam, deaths were registered among "other classes."

During 1888 the greatest number of deaths (73,090) took place in January and the least (41,850) in April. The most unhealthy months were December, January, and February, and April and May the most healthy. As usually happens a sudden rise occurred in the death-rate in the month of December.

According to districts, the highest death-rate (37·8), as has been the case for some years past, occurred in Madras, then Kurnool (31·1), being 6·7 less than Madras, and the lowest in Vizagapatam (12·5) and Godávari (15·2). In 11 districts (Chingleput, Kurnool, Madura, Malabar, Nílgiris, Salem, South Arcot, South Canara, Tanjore, Tinnevelly, and Trichinopoly) the recorded death-rates per 1,000 of population were higher in 1888 than in 1887, but in all the others they were lower. The greatest increase in the death-rates took place in the Malabar, South Canara, and Tanjore districts, and was chiefly due to the prevalence of cholera and small-pox in these districts in 1888. In South Canara there was also a marked increase in the number of deaths in 1888 from all other causes. The greatest decrease in the death-rate took place in the Vizagapatam district, where fewer deaths were registered from all causes in 1888 than in 1887. As in 1887, the mortality in Madras and Kurnool district was higher than in any other district, being above 30 per 1,000. In 10 districts the death-rates were between 20 and 30 per 1,000, and in nine districts below 20 per 1,000. The districts of Vizagapatam and Godávari in which the registered death-rates were 12·5 and 15·2 per 1,000 respectively are manifestly incorrect.

The death-rates among the urban and rural populations were respectively 27·9 and 20·7 against 26·1 and 21·0 in 1887. In all districts the urban death-rate was higher than the rural. The difference is most marked in the districts of South Canara and Malabar, the death-rates being respectively 46·9 and 35·3 in urban, and 24·7 and 18·4 in rural circles.

The subjoined table shows the number of deaths registered under the principal causes of mortality during the year 1888 compared with previous years :— Chief diseases.

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1868 - - -	390,956	8,036	34,330	105,692	—	9,242	233,659
1869 - - -	451,981	21,034	17,448	132,346	—	9,310	271,843
1870 - - -	451,020	55,867	11,252	151,027	—	12,325	220,549
1871 - - -	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872 - - -	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873 - - -	506,894	840	51,784	222,843	36,392	14,251	180,784
1874 - - -	516,848	313	48,343	226,220	37,993	13,065	190,914
1875 - - -	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876 - - -	680,384	148,193	23,469	230,092	38,176	11,175	229,279
1877 - - -	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878 - - -	810,921	47,167	56,369	374,443	48,083	15,007	269,861
1879 - - -	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880 - - -	454,101	613	14,529	209,940	19,622	10,845	198,552
1881 - - -	465,682	9,446	15,776	203,542	18,961	11,527	206,430
1882 - - -	470,700	23,604	20,159	188,561	19,958	11,611	206,807
1883 - - -	541,930	36,284	37,975	203,786	22,098	11,509	230,278
1884 - - -	650,335	75,476	61,247	215,977	28,775	11,502	257,358
1885 - - -	615,449	58,109	34,726	218,786	31,209	11,659	260,960
1886 - - -	553,927	12,417	17,129	221,679	27,379	13,103	262,220
1887 - - -	604,775	28,359	21,472	240,860	26,679	11,328	276,077
1888 - - -	597,015	58,677	21,858	204,561	27,721	11,401	272,797

This statement shows that, although the total mortality was less than that recorded in 1887, yet the number of deaths registered under each of the principal causes (with the exception of "fevers" and "other causes") was greater.

During the year 1888 there were 58,677 deaths registered from cholera in the Presidency, equal to 2·1 per 1,000 of population, or 30,318 more than in the preceding year. The total number of deaths from cholera for the past 21 years is seen in the table above. The number of cholera deaths in 1888 was exceeded in 4 out of the 20 years quoted, and was 16,548 above the last quinquennial mean. Cholera.

The above table also clearly shows the cycle in which the disease seems to run, viz., that every sixth year is a year of minimum intensity. The years of minimum intensity were 1868, 1874, 1880, and 1886, and it will be interesting to see if 1892 will also be a year of minimum intensity.

There was no month in the year when cholera was absent from the Madras Presidency. Taking the totals for each month it would appear that, as regards the Madras Presidency, cholera attains its maximum degree of intensity during the cold weather months. As a rule the greatest number of deaths are registered in either December or January. In January 1888 the exciting cause of the disease was especially active, when 18,787 deaths were registered. The disease then gradually subsided, and in May the deaths recorded were 1,694. In June and July the disease became intensified, causing 2,565 and 4,587 deaths respectively; it then decreased till December, when a rise took place.

The only district in the Presidency in which the disease did not appear was the Nílgiris. The ravages of the disease were most severely felt in the district of Tanjore, where 9,120 deaths (4·3 per 1,000 of population) were registered. In Tinnevelly district the death-rate was also high, viz., 4·3 per 1,000 of population. In the Vizagapatam district its incidence was but slight, 257 deaths being reported.

Of the 58,677 deaths registered from cholera, 30,397 were males, 28,280 females. The ratio per 1,000 of males was 2·2 and of females 2·0. The female deaths exceeded the male deaths in three districts (Madras, Malabar, and South Canara), but in the remaining 19 the reverse was the case.

Of the 55 municipal towns (excluding Madras) 50 were affected. In 38 municipal towns the death-rate exceeded that of the district, and in 12 it was less. In 5 municipalities (Ootacamund, Coonoor, Vizagapatam, Bimlipatam, and Anakápalle) no deaths were recorded from cholera.

The measures which were resorted to by the district authorities to prevent the spread of the disease were generally satisfactory. On cholera making its appearance in any town or village steps were at once taken to improve the surface conservancy, and to conserve, as far as possible, the water-supply. In some cases people were

prevented from taking water from supplies which were thought bad. These measures although they may have had some effect, can only be looked upon as palliative, the real remedy being the introduction of cleanliness into every village at *all* times, irrespective of epidemic times or seasons, and not confined only to periods when sickness is prevailing. The chief factor in reducing the mortality, not only from cholera, but also other diseases, and notably fevers, which cause many more deaths than cholera does, has been the introduction of cleanliness in villages and towns, and wherever thorough cleanliness prevails the mortality is reduced.

Small-pox.

In 1888 the deaths from small-pox of 11,117 males and 10,741 females, or a total of 21,858 persons, were recorded against 21,472 in 1887, and a quinquennial mean of 34,510. The small-pox death-rate for the Presidency in 1888 (0·8) was a little greater than in the previous two years, but lower than the mortality recorded in 1883, 1884, and 1885, and the average of the previous five years.

There were 4,513 children under one year of age, and 8,487 over one and under 12 years years of age, who died from small-pox during the year, out of a total of 21,858. A percentage of 20·7 occurred among infants under one year of age, whilst 38·8 per cent. took place among children over one and under 12, and the remaining 40·5 per cent. was among persons above 12 years of age.

During the year deaths from small-pox were registered in all the districts. The highest ratios—2·4 and 2·2—took place respectively in the Kurnool and Ganjam districts. In these two districts vaccination has always been opposed by the people, and its practice has been carried on under many disadvantages. In the Madura, South Canara, North Arcot, and Bellary-Anantapur districts the ratios per 1,000 of population were respectively 1·5, 1·5, 1·2, and 1·2. The lowest ratios—0·02, 0·04, and 0·09— took place respectively in Godávari, Kistna, and Madras districts.

Of the 55 municipalities, in 44 there were deaths from small-pox recorded. The highest death-rate, 9·5 per 1,000 of population, was in Mangalore, the district rate being 1·2. Parlákimedi comes next with a ratio of 6·9, the rate for the district being 2·2. The lowest ratio (0·03) per 1,000 of population took place in Masulipatam.

Fevers.

During 1888 there were 106,802 males and 97,759 females, or a total of 204,561 persons reported to have died from fever against 240,860 in 1887. There was thus a decrease of 36,299 for the year under report as compared with 1887, and the mortality was less in 1888 than in any of the four preceding years. On looking at the table on the preceding page it will be seen that the greatest number of deaths are from "fevers," and although cholera attracts more attention and naturally causes greater panic than fever, yet it ought not to be as much dreaded as "fevers," which are a far more prominent cause of excessive mortality than cholera. From 1879 to 1888 there were 316,281 deaths from cholera, but the deaths from fever for the same period were 2,193,169 or nearly seven times greater than the mortality from cholera. Although a principal cause in the reduction of the number of deaths from fever in 1888 would appear to have been the deficient rainfall and dryness of the year, yet there can be no doubt that there is some other factor or factors at work, besides the moisture, which assist the causation of fever.

In all the districts, with the exception of Bellary, Malabar, and Nílgiris, fevers caused a lower mortality during the year under review than in 1887. The greatest decrease (9,800) in the number of deaths from fever in 1888 when compared with 1887 was in the Vizagapatam district.

The cold weather months were those in which the greatest number of deaths occurred from fevers. In January there were 20,741 deaths, and in December 20,234. A great many cases of chest diseases are no doubt entered as "fevers" during the cold weather months, and the village officers cannot be supposed to be always able to distinguish between them and fever. The minimum mortality (15,480) took place in the month of April.

The death-rates in 23 municipal towns were greater in 1888 than in 1887, in 29 less, and in 3 equal. The highest death-rate is reported, as in 1887, from Berhampore. The mortality was, however, much less in 1888, 16·8 per 1,000 of population against 43·2 per 1,000 in 1887. The lowest death-rate (1·3) was recorded by Palamcottah. In 14 municipal towns the mortality from fevers was greater than that of the districts. The death-rate for municipalities was 5·6 per 1,000 of population against 6·3 in 1887, and among the rural population it amounted to 7·4 against 8·8 in the previous year.

As might be expected, owing to the greater prevalence of cholera in 1888 than in 1887, more deaths were returned from bowel complaints in the year under review than in the one preceding it. During the year bowel-complaints caused the deaths of 14,687 males and 13,034 females, or a total of 27,721 persons, against 26,679 deaths in 1887. At table on page 101 is seen the number of deaths from bowel complaints in each year since 1871. The number of deaths was exceeded in 10 out of the 17 years quoted, but was 493 above the last quinquennial mean. The death-rate for the year under review was 1·0 per 1,000 against 0·9, the rate for last year, and 0·9, the average rate per 1,000 for the five-year period, 1883–1887. In 13 districts the death-rate was higher in 1888 than in 1887, in 2 equal, and in 6 lower. The increase in the death-rate in some districts was probably due to the deficient rainfall, as the water of tanks was much reduced in quantity, and therefore had a much larger percentage of suspended and dissolved impurities, and, in places where wells, &c. failed, people had to take water from impure sources. Madras, as usual, heads the list, with the high death-rate of 6·5 per 1,000 of population, or 0·8 less than in 1887. Following it comes Chingleput with a ratio of 4·2 per 1,000 against 4·0 per 1,000 in 1887, and next to it South Canara (2·3). These three districts also obtained the highest death-ratios in 1887. The lowest ratio, viz., 0·3, was returned by the Kistna and Vizagapatam districts. In 1887 the ratio in the Kistna district was 0·2, and in the Vizagapatam district 0·6. **Bowel complaints.**

The district presidency rate was 0·8 or 2·4 less than the municipal presidency rate (3·2). In 46 municipal towns the death-rate was higher than in the districts, in only 8 it was lower, and in 1 equal. The highest death-rate in municipal towns from bowel complaints is reported to have occurred at Tuticorin, where it attained the rate of 9·4 per 1,000 against 8·2 in 1887. The lowest death-rate (0·1) was recorded by Masulipatam and Adóni.

The deaths from injuries in 1888 were 11,401, or 73 more than in 1887; of the 11,401 deaths, 2,483 were registered as due to suicide, 6,587 wounds and accidents, and 2,331 were killed by snakes and wild beasts. There was an increase in the number of suicides (699), and persons killed by snakes and wild beasts (126) in 1888 as compared with 1887, but a decrease in the deaths from wounds and accidents (752). The greatest number of suicides occurred in Nellore district, and the fewest in Madras. The highest death-rate from injuries (0·7) was obtained by Nellore, and the lowest (0·08) by Nílgiris. **Injuries.**

There were 272,797 deaths registered under the head of "all other causes," being 3,280 less than in 1887, when 276,077 were returned under this head. The death-rate under this head was 9·8 per 1,000, the same as in the previous year. **All other causes.**

Sanitary Works.

Excluding the town of Madras, which has an Act of its own, 55 towns in the mofussil were administered by the District Municipalities Act IV. of 1884 during 1888, being one more than the number in 1887. The town of Bezváda, with a population of 9,336, was constituted a municipality from the 1st April 1888. **Municipalities.**

Sanitary Works.—No new works of any importance were undertaken. As usual, the improvements consisted in the sinking of wells, in the repairing and cleansing of tanks and wells, in the repair and construction of latrines, drains, roads, dust-bins, markets, and slaughter-houses, &c.

Water-supply, Drainage and Conservancy.—The great desiderata appear to be an improved water-supply and a good system of drainage. In some towns, however, the water-supply is fair, and in some again masonry drains do exist, but they are faulty in construction and not laid down on any systematic plan. To effect any radical reform in this direction large sums of money (which the municipalities can ill-afford) and efficient engineering agencies who can undertake the preparation of schemes on a large scale, are absolutely necessary. If in any instance the latter be available, the want of funds to employ them is a great impediment. However, as has been observed by Government, it is hoped that these obstacles will be overcome to some extent by the recent resolution of the Government of India, which authorises the grant of loans to local bodies for the purposes of sanitary improvement. It is in large towns like municipalities governed by a corporation that sanitary improvements should be established on a firm basis, so that they may form the centres from which people in

other towns and villages interested in sanitation may take an example in effecting sanitary reforms.

The system of conservancy generally was essentially the same as that detailed in former reports. The arrangements made in the majority of the towns were on the whole good and fairly well carried out. In some towns they were indifferent and unsatisfactory, notably so in Coonoor and Tirupati. The unsatisfactory state of things in the former was brought to the special notice of the Government, and it is hoped that the orders passed on the subject will be productive of good. The condition of the latter in regard to its conservancy is described by the Deputy Sanitary Commissioner, who visited Tirupati during the year, thus: "There is one public urinal, for which no "buckets have been provided. There are no public latrines. Portions of backyards "are set apart for private resort, holes being left in the walls so that pigs may enter "and clean up. People defæcate anywhere, and the whole town is pervaded with the "odour of pig's dung and human excreta."

Private scavengering made progress during the year under review as compared with its predecessor. It was undertaken by municipal agencies in 37 towns, being one more than in 1887, and 16,071 private dwellings, against 15,668 in 1887, were daily cleansed, showing a forward step towards house conservancy. In 19 towns there was an increase in the number of private privies under municipal management; in 10 there was a decrease, and in 8 the numbers were the same as in 1887.

The total estimated income of the 55 municipalities, exclusive of Madras, during the year 1888–89 amounted to Rs. 19,88,130 against Rs. 19,61,310, indicating an incidence of Rs. 1-5-10 per head of population against Rs. 1-5-9 in the previous year. The amount set apart for sanitation was also greater than that in the preceding year, viz., Rs. 6,81,294 against Rs. 6,28,622. Except in some few towns, such as Ongole (10·9), Pálghat (12·3), Anantapur (12·6), Calicut (13·9), and some others, where the percentages of the sanitary allotment to income were low, the majority of the municipalities contributed very fairly out of their revenues towards sanitation. Three towns, Trichinopoly (56·7), Cuddapah (56·4), and Vellore (54·7), contributed more than 50 per cent. In six towns the percentages were between 40 and 50, in 19 they were between 30 and 40, in 18 between 20 and 30, and in nine below 20, which must be considered as inadequate; and in keeping with the inadequacy of the grant, the sanitary improvements made in these nine towns were not much. Although the allotments made by the municipal councils of Cuddapah and Vellore are large, it is to be regretted that the expenditure during the nine months ending with December 1888 is not in proportion to the sanctioned grants. In Cuddapah, out of an allotment of Rs. 49,894, only Rs. 10,644, and in Vellore, out of Rs. 40,577, only Rs. 11,267 were spent, leaving Rs. 39,250 and Rs. 29,310 respectively to be spent in the next three months of the year.

Of the total sanitary grant of Rs. 6,81,294, Rs. 4,33,187 were spent during nine months of the year, leaving a balance of Rs. 2,48,107, or more than one-third, to be spent in three months. But taking the transactions of 1887–88 which are for the full year, it is observed that out of an allotment of Rs. 6,28,622, only Rs. 5,59,307 were spent, thus allowing a sum of Rs. 69,315 to lapse unutilised. In 15 towns the expenditure exceeded the sanctioned grant more or less, in 38 it fell short in sums varying from Rs. 25 in Cannanore to Rs. 17,740 in Trichinopoly. In Chidambaram the difference was but a trifle, only Rs. 3. The greatest defaulters in this respect were Trichinopoly, Vellore, Masulipatam, Tinnevelly, Madura, and Tanjore.

District local fund boards.

There was no change in the number or constitution of the District Local Fund Boards during the year. They numbered 21 as in 1887, corresponding with the number of districts or collectorates. For the purposes of administration under Act V. of 1884, the districts in the Presidency are divided into three grades, viz., unions, taluk, and district boards, who have to provide, among other things, for the sanitation of towns and villages. The functions of the first extend to villages, of the second to sub-divisions of districts, and of the third to the entire district. There were in all 85 taluk boards and 237 union panchayats.

As in the municipalities so also in rural areas outside municipal limits, no works of any importance were undertaken during the year, but various minor improvements were carried out,—and these consisted, as usual, in improvements to water-supply and village sites and in the construction and repair of markets, slaughter-houses, dust-bins, latrines, and drains. The sources of water-supply were the same as in former years, viz., tanks, wells, irrigation channels, rivers, and streams. Some of these are set apart for drinking purposes only, and guarded from pollution by the employment of

watchmen. There was no change in the system of drainage since last reported upon. It consisted chiefly of side cuttings to carry off storm-water. In some few towns masonry drains exist, but they form no part of a regular system. Sewage and waste water from houses either flow into the side cuttings or drains, or are caught in cess-pools, or allowed to run into back yards where they sink in the soil. Conservancy, chiefly surface cleansing, was attended to in 704 cusbah towns and large villages, near the sub-divisions where supervision can be more easily exercised, against 672 in 1887. Special establishments were maintained in them according to the circumstances of each, and the street sweepings, filth, rubbish, &c., were collected and removed to a distance; in the majority of instances they were used as manure in fields, and sometimes buried or burnt. In villages where no establishment is employed the owners of houses attended to the conservancy. In nine districts the number of conserved villages was the same as in 1887, in one it increased by 6, in another by 4, in two by 2, and in six by 1. In Coimbatore the number decreased by 2, while Nellore, which in 1887 stood conspicuous in having no villages conserved, had scavengering establishments employed in 14 villages in 1888.

Since the constitution of local self-government sanitation in rural tracts has become to be generally appreciated, and this is manifest from the desire evinced by the authorities to remedy defects pointed out, and to carry out the recommendations made by the sanitary inspecting officers. A pure water-supply, a good system of drainage, and effective conservancy, including domestic cleansing, are the chief elements of sanitation that demand the most serious attention, and, as has been remarked by the Government of India, the powers conferred by legislation on local boards in these respects are very considerable, and ample scope is given to them for raising funds by methods of local taxation for local improvements. If only the powers thus vested in them be properly directed, and the provisions of the law relating to sanitary matters be persistently enforced, and if the money set apart for sanitary purposes year after year be fully utilised and remedial measures systematically adopted, much good will result, and the difficult problem of the sanitation of our rural towns and villages will in the end be satisfactorily solved.

The total sanitary grant made by all the district boards for the year 1888–89 amounted to Rs. 4,85,357 against Rs. 4,48,010 in 1887–88. Taken as a whole the allotment seems to be fair. Individually considered too a fair contribution of the revenues was made by each district except four towards sanitation. The four districts in which the allotments were inadequate are Malabar, Nellore, Ganjam, and South Canara. Of the total sanitary allotment Rs. 2,61,862 were spent during the nine months ending December 1888, leaving Rs. 2,23,495, or less than one-half, to be expended in the remaining three months of 1888–89. It is not likely that the whole of this amount would have been spent during that period;—past experience shows that some portion of it would be allowed to lapse unutilised. Taking the figures for 1887–88, which are for the whole year, we find that out of sanctioned allotment of Rs. 4,48,010 only Rs. 3,71,776 were spent, leaving a balance of Rs. 76,234 unexpended, which is to be regretted. In every district except five—Ganjam, Godávari, Chingleput, Anantapur, and Nílgiri, which utilised their sanitary allotments very nearly to their full extent, and the three last even somewhat in excess—portions of the sanctioned grant were, in varying sums, allowed to lapse unexpended. In this respect Nellore, as must be expected from its marked apathy and indifference to sanitation, as noticed by the district medical and sanitary officer, stands pre-eminent.

Personal Proceedings and General Remarks.

During the year I visited 24 municipal towns, and the Deputy Sanitary Commissioner 19. In addition, many small towns and villages were inspected.

In my inspection of municipalities I was usually accompanied by some members of the Municipal Council, to whom I pointed out the chief sanitary defects I observed, and the way in which they could most easily be remedied. I dwelt on three subjects which are all capable of being easily worked, and which required no special technical training or knowledge. These subjects are measures well within the means and unaided powers of execution of the several Municipal Committees, and are the following:—

(i.) Public scavengering of towns on a systematic plan, and under strict supervision.
(ii.) Prosecution of the practice of vaccination as a protection against epidemics of small-pox; and
(iii.) Attention on the part of the people generally to domestic and personal hygiene, especially in reference to the provision of suitable means for the proper

ventilation of their dwellings and protection of their bodies against adverse influences of climate, &c.

In nearly all municipal towns a supply of good water is much wanted, and there is also urgent need for comprehensive schemes of drainage. There is ample evidence, however, that the sanitary improvements of our municipalities are engaging the attention of the Municipal Councils, and that they are alive to the necessity of carrying out sanitary measures on a more systematic plan than has hitherto been the rule. For the prosecution of sanitary measures in many municipalities, a difficulty has been experienced in preparing designs, &c., as no competent agency could be obtained for the work. In Tanjore, Negapatam, Madura, Dindigul, Salem, Cuddapah, Conjeeveram, Trichinopoly, and Tinnevelly, schemes for obtaining a supply of good and sufficient water are under consideration, and for Kumbakónam and Negapatam drainage schemes have been prepared.

A chief cause of sickness and death in towns is the insanitary condition of the private houses and back yards. The houses are badly ventilated, the back yards very often dirty, and drainage of them most defective, and the latrine arrangements unsatisfactory. It is, therefore, no wonder that the death-rate of towns is higher, as a rule, than that of the small towns and villages where the people, at any rate, have comparatively purer air to breathe.

From the various inspection reports, there is also evidence that an advance in the path of rural sanitary reform has been made in some districts. The Kurnool district board have, at present, a scheme under consideration for the improvement of conservancy in villages with over 2,000 inhabitants, and for smaller villages situated on important trade routes. This district board some time ago decided that at first a beginning be made with a single town, where the benefits derived from efficient sanitation could be practically shown to the people. The town of Nandyál was fixed upon, and a part of the drainage scheme has been carried out. With reference to this, the District Medical and Sanitary Officer reports that already "good has been effected, "not only to the inhabitants, but has caused a general appreciation of sanitary work "by villagers coming from distant parts of the district. Through the generosity of a "private individual, all the work of drainage in one of the streets of Nandyál was "carried to its logical conclusion, namely, the perfection of house connexion, and the "correct preparation of receiving surfaces both for household water and for drainage "from stables, cow-stalls, &c. Concrete pavements for courtyards and cattle sheds "were also laid down by private funds." In Bestawarpett, an important village in the Cumbum taluk, the inhabitants have volunteered to pay for the same character of drains.

In my letter, No. 170, dated 28th February 1887, to Government, I recommended that all the rubbish and filth of back yards and compounds of houses in towns and villages should be removed and stored in depôts situated outside the towns and villages, and that the manure thus collected should, under the superintendence of the revenue authorities, be distributed to the contributors as manure for their fields during the cultivating season. From a report received, it would appear that there are 54 villages in the Kurnool district, where sites for this purpose have been selected and maintained by the District Board for the storage of manure heaps belonging to private owners.

In accordance with Government Order, No. 966L., dated 30th May 1887, Local and Municipal, several municipalities and District Boards forwarded plans of sanitary works for approval.

In Tinnevelly district, the chairman of the Melavivaragavapooram Union wrote a pamphlet called "Hints on Sanitation," which was printed and circulated to all taluk boards in the district.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1888.

(*Dr. C. W. Macrury.*)

Vital statistics.

In the Presidency of Bombay, including Sind, during the year 1888 the births of 330,316 males and 304,377 females, or a total of 634,693 children, were registered against 327,500 and 300,693, or a total of 628,193 children, in 1887. The births are 6,500 in excess of the number recorded in the previous year, whilst they exceed the mean of the preceding ten years ending 1887 by 167,523.

The following table shows the number of births registered in each year from 1878 to 1888, their ratios per 1,000 of population, and the proportion of males to females:—

Years.	Population.	Number of Births Registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1878 - - -	16,181,741	128,848	114,405	243,253	7·96	7·07	15·03	52·97	47·03	88·89
1879 - - -	16,228,774	151,460	136,410	287,870	9·33	8·41	17·74	52·61	47·39	90·06
1880 - - -	16,228,774	195,285	175,588	370,873	12·03	10·82	22·85	52·66	47·34	89·91
1881 - - -	16,454,414	239,912	219,745	459,657	14·58	13·35	27·93	52·19	47·81	91·59
1882 - - -	16,454,414	255,927	235,419	491,346	15·55	14·31	29·86	52·09	47·91	91·98
1883 - - -	16,454,414	261,966	239,835	501,801	15·92	14·58	30·50	52·20	47·80	91·55
1884 - - -	16,454,414	278,986	255,737	534,723	16·96	15·54	32·50	52·17	47·83	91·67
1885 - - -	16,454,414	298,406	274,025	572,431	18·14	16·65	34·79	52·13	47·87	91·83
1886 - - -	16,454,414	303,376	278,177	581,553	18·44	16·90	35·34	52·17	47·83	91·69
1887 - - -	16,454,414	327,500	300,693	628,193	19·90	18·27	38·18	52·13	47·87	91·81
Mean for 10 years	16,382,019	244,167	223,003	467,170	14·90	13;61	28·51	52·26	47·74	91·33
1888 - -	16,454,414	330,316	304,377	634,693	20·07	18·50	38·57	52·04	47·96	92·15

The recorded birth-rate for the year is 38·57; that for 1887 was 38·18, an improvement of ·39 per 1,000 over last year.

The number of births recorded in each district in 1888 was higher than in the previous year except Eastern Gujarát. The recorded births in the Western Registration District were 143,747, and in the Southern Registration District 132,364. In 1887 the figures were 138,372 and 127,735 respectively. The births exceed the mean of the preceding ten years ending 1887 by 30,835 in the Western and 37,482 in the Southern. The births in the district of Eastern Gujarát were less by 5,560 in 1888 than in 1887. Dr. Colah, the Deputy Sanitary Commissioner, Eastern Gujarát Registration District, remarks in his annual sanitary report that "of the eight years the year 1888 was the worst in point of public health, for it is the only year in which the deaths exceed the births."

The total increase for the Presidency was 10·06 per 1,000 of population above the mean of the preceding ten years. In the City of Bombay more attention seems to have been paid during the year 1888 to the registration of births, which is still extremely defective. Out of the 56 towns in the Presidency the City of Bombay occupies the eighth place from the bottom of the list.

The recorded birth-rates among the urban and rural populations of the presidency were respectively 28·44 and 40·07 against 27·94 and 39·69 in 1887. Amongst the rural population of each collectorate, except Ratnágiri, Kánara, Karáchi, Hyderabad, Thar and Párkar, and Upper Sind Frontier, the birth-rates were higher than in the urban circles. In 1887 the birth-rates amongst the rural circles were higher than in the urban circles in each of the collectorates except Ratnágiri, Kánara, Ahmedabad, Karáchi, and Hyderabad.

Out of 56 towns in the Presidency 12 returned a birth-rate exceeding 40 per 1,000. In many towns, however, the registration of births is still much neglected, particularly in zilla stations, where one would have supposed the wishes of Government would have been more strictly attended to. For example, in the town of Thána a birth-rate of only 10·51 per 1,000 was recorded against 8·65 in 1887; in the town of Sholápur a birth-rate of 15·53 was registered against 19·82; and in the town of Násik 16·72 against 19·83 in 1887. In the towns of Poona and Belgaum the recorded birth-rates

were respectively 27·98 and 29·03 per 1,000 against 28·39 and 27·56 in 1887. Birth-rates, such as Thána 10·51, Kalyán 12·55, Sholápur 15·53, Násik 16·72, Chopda 17·37, and those returned by Mahád and Karád, are absolutely valueless. These and other municipalities, which have returned similarly inaccurate birth-rates, cannot be performing their duty properly, and I hope Government will be pleased to call the especial attention of the authorities to the necessity for much greater attention being paid to this most important subject.

Among the civil population in the 285 rural, town, and cantonment circles in the Presidency of Bombay, the deaths of 243,719 males and 224,320 females, or a total of 468,039 persons, were recorded during the year 1888. In the previous year 455,261 deaths, or 12,778 less than in 1888, were registered. The following statement shows the number of deaths recorded in each year since 1878:—

1878	- 532,951	1882	- 343,418	1886	- 381,185
1879	- 387,542	1883	- 420,198	1887	- 455,261
1880	- 328,673	1884	- 408,409	1888	- 468,039
1881	- 381,450	1885	- 473,591		

so that, as compared with the previous two years, 1888 was an unhealthy year. The computed death-rate per 1,000 of population in 1888, was 28·44 against 27·67 in 1887 and a decennial mean of 25·10. Omitting Sind, where registration is very defective, the recorded death-rate in the other parts of the Presidency amounted to 30·33 per 1,000 of population.

The millesimal ratio of males dying to males living was 28·68, and of females dying to females living 28·19. In 1887 these ratios were respectively 28·05 and 27·26. For every 100 females who died 108·65 deaths among males were registered, but these proportions varied considerably in some of the collectorates.

In 1888 the recorded death-rate per 1,000 of population was higher than in 1887 in each of the collectorates, except Khándesh, Ahmednagar, Poona, Sholápur, Sátára, Bijápur, and Panch Maháls. In Násik, Ratnágiri, and Hyderabad the recorded death-rates were slightly in excess of those for 1887. In the collectorate of Násik it was 32·14 per 1,000 of population against 31·22 in 1887; in Ratnágiri 17·20 against 16·38; and in Hyderabad 16·69 against 15·86. In the collectorates of Kánara, Shikárpur, and Upper Sind frontier, the recorded death-rates (26·59, 16·36, and 11·98) were nearly the same as in 1887 (26·91, 16·67, and 11·86 per 1,000 respectively). It was also higher than the annual mean of the preceding ten years in 19 of the 24 collectorates, the exceptions being Khandesh, Bombay, Kánara, Panch Maháls, Ratnágiri. In Ratnágiri the death-rate (17·20 per 1,000) was nearly the same as that of the annual mean of the preceding ten years (17·27).

In the City of Bombay, Broach, and Ahmedabad, the recorded birth-rate was much below the registered death-rate. In the City of Bombay they were respectively 21·30 and 28·61 per 1,000 (the difference may be ascribed to defective registration and probably women leaving Bombay for child-birth), in Broach 36·69 and 42·27, and in Ahmedabad 36·29 and 39·31. In Thána and Surat the recorded birth-rates (30·66 and 39·56 per 1,005 respectively) were also below the registered death-rates (31·77 and 40·68). In the collectorate of Kaira the recorded birth-rate was nearly the same as that of the death-rate (34·52 and 34·40 per 1,000 respectively). In all other collectorates the recorded birth-rates were considerably higher than the registered death-rates.

The mortality amongst infants under one year (21·32 per cent. of total deaths) and children above one year (20·99) but under five was, as usual, very high in comparison with other periods of life. In fact the deaths among children under five years of age formed 42·31 per cent. of the total deaths. The period of greatest immunity was in the age of above 10 and under 15, the rate being 7·10 per 1,000. The percentage on total deaths amongst infants under one year was 21·32 against 21·88 in 1887. For those above one and under five the percentage on total deaths was 20·99 against 22·52 in 1887. For old people 60 and upwards the percentage on total deaths was 12·99 against 12·40 in 1887.

According to the census of 1881, the Mahomedan population numbered 3,107,171 persons, amongst whom in 1888, 65,203 deaths were recorded against 62,176 in 1887, the death-rate per 1,000 being 20·98 against 20·01 in 1887. The Hindu population amounted to 13,128,587 persons, amongst whom 396,887 deaths, or 30·23 per 1,000 of population, were reported during 1888. In 1887 the total deaths amongst this race were 387,655, equal to a death-rate of 29·53 per 1,000. Amongst the Christian

population, numbering 138,326 persons, 2,590 deaths were reported during the year against 2,307 in 1887, the death-rate being 18·72 against 16·68 per 1,000 in 1887. Under the heading "Other castes" are included all those not belonging to either of the above sects, who by the census of 1881 numbered 80,330 persons, amongst whom during 1888 there were 3,359 deaths against 3,123 in 1887, the death-rate being 41·81 per 1,000 against 38·88 in 1887.

The subjoined table shows the deaths in 1888, arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1887 and the mean of the preceding ten years.

Causes of Deaths.	Mean for 10 Years, 1878-87.		1887.		1888.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera - - -	19,389	1·18	25,711	1·56	36,500	2·22
Small-pox - - -	4,387	0·27	3,753	0·23	3,617	0·22
Fevers - - -	285,468	17·43	308,722	18·76	304,449	18·50
Bowel complaints - -	34,621	2·11	42,634	2·59	45,462	2·76
Injuries - - -	6,099	0·37	5,558	0·34	5,731	0·35
Other causes - - -	61,303	3·74	68,883	4·19	72,284	4·39
All causes - -	411,267	25·10	455,261	27·67	468,039	28·44

The recorded death-rates among the urban and rural population of the Presidency were respectively 31·35 and 28·04 against 28·05 and 27·63 in 1887.

Cholera.

During 1888 19,110 males and 17,390 females, or a total of 36,500 persons, died from cholera, while in the preceding year 25,711 deaths were registered from this disease.

In January 1888 cholera prevailed in 10 collectorates and caused 499 deaths. In February the disease was present in 9 collectorates, causing 204 deaths, the monthly minimum for the year. In March 896 deaths from cholera were returned from 14 collectorates. In April the disease increased and caused 2,819 deaths. In May the disease had spread to 16 out of the 24 collectorates in the Presidency, and 5,674 deaths were reported from it. During June the disease assumed an epidemic form, as the mortality rose to 9,801, the maximum for the year, and it was present more or less in 18 zillas. In July, August, and September it subsided, as the deaths were 5,996, 3,966 and 1,763 respectively. In October the mortality rose to 2,371. In November a decline took place, as 1,471 deaths were reported from 15 collectorates. In December 1,040 deaths from cholera were returned from 15 collectorates.

In the Surat Collectorate the death-rate attained the high ratio of 7·07 per 1,000. In the Thána, Broach, and Ahmedabad zillas there were also high death-rates, namely, 5·88, 5·75, and 5·70 per 1,000, whilst in the Kolába Collectorate, although it was not so intense, it still reached the high ratio of 4·05 per 1,000. The epidemic in the remaining collectorates, although widely distributed, did not exhibit high ratios.

Out of the 24,535 villages in the Presidency 3,127 or 12·74 per cent., were affected by cholera. The highest percentage occurred in the Broach Collectorate, where out of the 403 total number of villages 163, or 40·44 per cent., were affected. In Ahmedabad, Surat, and Thar and Párkar Districts the percentages were 36·40, 36·28, and 34·72 respectively. In the Panch Maháls, Dhárwár, Belgaum, and Kaira Collectorates the percentages were between 25·26 and 20·10, and in Poona, Thána, Kárachi, Sholápur, Ahmednagar, Bijápur, and Sátára 17·86, 16·70, 15·65, 15·51, 13·74, 13·52, and 11·49; whilst the remaining 8 collectorates were below 10. Shikárpur and Upper Sind Frontier Districts enjoyed perfect immunity from cholera this year.

Small-pox.

During 1888 there were 3,617 deaths from small-pox—1,852 males and 1,765 females, against 3,753 in 1887, and a decennial mean of 4,387.

In the Western Registration District small-pox attained a ratio of 0·44 per 1,000 against 0·77 in 1887 and a decennial mean of 0·37. In the Central Registration District the ratio was 0·26 against 0·04 in the previous year and 0·18 the decennial mean. In Sind it was 0·21 against 0·08 in the previous year and a decennial mean

of 0·21. In the Southern and Eastern Gujarát Registration Districts the ratios per 1,000 of population were respectively 0·05 and 0·02 against 0·02 and 0·07, and the decennial mean of 0·39 and 0·19. In the collectorates the highest death-ratios, 0·68 and 0·56, took place respectively in Násik and Poona Collectorates, and 0·62 in the Town and Island of Bombay. In only one collectorate—Kaira—no death was recorded from small-pox.

Fever.

During 1888, 157,528 males and 146,921 females, or a total of 304,449 persons, were reported to have died from fever against 308,722 in 1887, a decrease of 4,273 for the year; the mean for the previous 10 years was 285,468.

In the Eastern Gujarát Registration District fever caused a higher mortality, 26·58 per 1,000, during the year than in 1887, when it was 25·13; the decennial mean was 23·87. In the Western Registration District the death-rate was 17·79 against 19·35 in the previous year, and the decennial mean 17·43. In the Central Registration District the ratio was 17·63 against 18·60 in 1887, and 16·51 the decennial mean. In the Southern Registration District the ratio was 15·51, or 0·14 higher than 1887, but 0·76 less than the decennial mean, 16·27. In the Sind Registration District the rate for the year (15·18) was higher by 0·75 than 1887 and 2·44 than the decennial mean. In the collectorates of Thána, Kolába, Ratnágiri, Belgaum, Dhárwár, Surat, Kaira, Ahmedabad, Karáchi, and Hyderabad, and in the Town and Island of Bombay there was an increase in the ratios during the year over 1887. The collectorate of Broach heads the list with a very high ratio, 31·17 against 33·39 in 1887 and 28·93 in the previous 10 years, and in the following collectorates high ratios are observed:—Ahmedabad 27·06, Kaira 26·28, Surat 25·90, Ahmednagar 21·77, Panch Maháls 21·65, and Násik 21·24, the presidency ratio being 18·50 against 18·76 in the previous year and 17·43 the decennial mean.

Bowel complaints.

During 1888 bowel complaints caused the deaths of 24,912 males and 20,550 females, or a total of 45,462 persons against 42,634 in 1887, and a decennial mean of 34,621.

The Southern Registration District heads the list with a high ratio of 5·86 against 4·95 in 1887, and 3·42 the decennial mean. The Western Registration District comes next with a ratio of 3·28, and next to it the Central Registration District 2·25, the Eastern Gujarát Registration District 1·91, and Sind with a rate of 0·20. In the Presidency the rate was 2·76 against 2·59 in the previous year, and a decennial mean of 2·11. In 14 collectorates the death-rate was higher, and in 10 lower than in 1887. The highest ratios were recorded in Belgaum 8·36, and Dhárwár 6·48, and the lowest in Hyderabad 0·07 and Shikárpur 0·12.

Injuries.

During 1888, 3,312 males and 2,419 females, or a total of 5,731 persons, met with violent deaths. The mortality from these causes is greater by 173 than that reported in 1887, when 5,558 deaths were recorded. Of these 5,731 deaths, 2,350 were caused by drowning, 1,185 resulted from snake-bites, 545 from wounds, 202 from hanging, 148 by poisoning, 115 from attacks by wild beasts, and 1,186 from causes not specified.

Vaccination.

Considerable difficulty is experienced in keeping up arm to arm vaccination in some towns on account of the refusal of parents to allow vaccinators to take lymph from their children; and as animal vaccination entails expenditure beyond the means of most municipalities, it would be advisable to make it obligatory to give lymph when required. This would be a preparatory step to making vaccination compulsory, which can only be a matter of time.

I have long been of opinion that vaccination in Native States should be as efficiently performed as in our own territory, and after some correspondence on the subject Government were pleased to issue Resolution No. 6560, dated 2nd October 1888, Political Department, from which I anticipate favourable results on the whole. Some chiefs, however, have not met the proposal in such a liberal and enlightened spirit as might be wished, but it is hoped they will carefully consider the importance of the measure to their subjects as well as the interest of the public at large, and act up to the wishes of Government, which is really their own advantage.

The department is much below its proper strength, and unless increased it will not be possible to protect the public against the ravages of small-pox, which during the

year has invaded several towns and villages in the Presidency and Sind. The necessity for increasing the establishment is proved by the number of villages in which the vaccinators are unable to complete primary vaccination work during each year. I have had personal and disappointing experience of this fact in the Central Registration District, where I endeavoured, but failed, to get primary vaccination work completed twice a year in towns and villages with a population of 500 and upwards, and annually in villages under 500. When primary work is so backward, it is not surprising to find re-vaccination so much neglected as it is.

The strength of the Vaccination Department during the year 1888–89 was as follows:—

5 Deputy Sanitary Commissioners.
4 Superintendents of Vaccination.
32 Inspectors of Sanitation and Vaccination.
6 Assistant Superintendents of Vaccination.
29 Clerks and kárkúns.
534 Vaccinators.
535 Peons.

There has been an increase of one Superintendent of Vaccination, 10 vaccinators and one peon for the year.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1887–88:—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total Number of Persons operated on.			
	1887-88.	1888-89.	Increase.	Decrease.	1887-88.	1888-89.	Increase.	Decrease.	1887-88.	1888-89.	Increase.	Decrease.
IN CIVIL LIFE.												
Itinerant	867,736	885,719	17,983 / 2·07	—	47,205	48,271	1,066 / 2·26	—	914,941	933,990	19,049 / 2·08	—
Dispensary	8,501	6,703	—	1,798 / 21·15	734	374	—	360 / 49·05	9,235	7,077	—	2,158 / 23·37
Total	876,237	892,422	16,185 / 1·85	—	47,939	48,645	706 / 1·47	—	924,176	941,067	16,891 / 1·83	—
IN ARMY LIFE.												
Native Army	3,117	3,594	477 / 15·30	—	1,352	4,604	3,252 / 240·53	—	4,469	8,198	3,729 / 83·44	—
British Army	401	378	—	23 / 5·74	499	1,451	952 / 190·78	—	900	1,829	929 / 103·22	—
Total	3,518	3,972	454 / 12·91	—	1,851	6,055	4,204 / 227·12	—	5,369	10,027	4,658 / 86·76	—
Total for the whole presidency.	879,755	896,394	16,639 / 1·89	—	49,790	54,700	4,910 / 9·86	—	929,545	951,094	21,549 / 2·32	—

896,394 persons were primarily vaccinated and 54,700 re-vaccinated against 879,755 and 49,790 in 1887–88, showing a net increase of 16,639 or 1·89 per cent. in primary vaccination and 4,910 or 9·86 per cent. in re-vaccination. The rate of decrease in primary and re-vaccination in dispensaries was 21·15 per cent. in the former, and 49·05 per cent. in the latter. The only decrease (23·37 per cent.) under the total operations was also amongst dispensaries. This decrease was due to the transfer of vaccination work from the medical officers in charge of dispensaries to the táluka vaccinators under the orders of Government in Resolution No. 3851, dated 1st November 1886. On the whole there has been an increase of 21,549, or, in other words, for every 100 persons operated on in 1887–88, the numbers for this year have been 102·32.

The following table shows the number of infants successfully vaccinated during the last two years in the presidency *exclusive of Native States*. The birth and death statistics are taken for the calendar year, as usual, in calculating the number available for vaccination, because infants are generally not vaccinated until three months after birth:—

Years.	Children Vaccinated successfully.		Children available for Vaccination.	Births returned as having been registered.	Deaths registered among Children under 1 year.
	Those under 1 year.	Those between 1 and 6 years.			
1887-88	376,791	144,687	528,556	628,193	99,637
1888-89	386,308	148,353	534,901	634,693	99,792

The above table shows that the successfully vaccinated fell short of the registered births, minus deaths amongst those under one year old. Out of 534,901 infants available for vaccination 386,308 or 72·22 per cent. have been protected. Last year the percentage was 71·29.

Out of 896,394 persons primarily vaccinated 851,718 or 95·02 per cent. were successful; being 0·38 per cent. less than in 1887–88. The number of unsuccessful cases was greater than in the preceding year, being 16,357 against 15,511. 1,712 persons were operated on a second time on account of the failure of the first operation, and in 30,031, or 3,563 cases more than in the year preceding, the result was unknown.

During the year 54,700 persons were re-vaccinated against 49,790 for 1887–88. In 210 cases re-vaccinations were repeated, in 8,203 instances the results could not be ascertained, and in 13,166 the operations failed. The number of successful cases was 33,541, or 61·32 per cent. against 65·16 in the preceding year.

The total number of persons operated on was 951,094, and of these 885,259 or 93·08 per cent. were successful. This latter number consists of civil population 872,746, dispensary 6,247, British and Native Army 6,266. In 1887–88 the percentage was 93·78. 1,922 persons were operated on more than once, the "unsuccessful" numbered 29,523 and the "unknown" cases were 38,234.

The ratio to the total population of protection by successful primary operations was higher than last year in the Western Registration District, Southern Registration District, Eastern Gujarát Registration District, and Sind Registration District, whilst in other districts it was lower. It was lowest of all in the Presidency Circle, being 22·86 per 1,000. In British and Native territory it was respectively 32·81 and 33·03 against 31·87 and 32·97 per 1,000 of population in the previous year. On the whole, 32·89 persons of all ages per 1,000 of population, against 32·37 last year, 31·91 in 1886–87, 31·94 in 1885–86, 29·84 in 1884–85, 30·89 in 1883–84, and 29·74 in 1882–83 were primarily vaccinated successfully.

The age details are compiled for three periods, viz. :—under one year, between one and six, and above six years. The numbers under each period primarily vaccinated were respectively 624,747, 256,506, and 15,141 against 611,361, 254,690 ,and 13,704 during the preceding year.

The quality of the lymph in use throughout the year was good. There were three consignments of English lymph, one of 45 tubes, and two of 65 tubes each. An addition of 20 tubes of calf lymph was made to the usual supply of 45 tubes on the requisition of the Superintendent of Vaccination, Presidency Circle, Bombay. Besides this there was one consignment of six tubes for Aden during the year.

Animal vaccination was carried on in Bombay, Poona (city and cantonment), and Rájkot. The operation of inoculating heifers was generally successful. In the Western Gujarát Circle animal vaccination was carried on at Rájkot in the months of September, October and November 1888, and the lymph was distributed twice to all the vaccinators in this circle. Except in Bombay City, where animal lymph only is issued, and in Poona and Rájkot, where both animal and human lymph were in use, vaccination in all other places as a rule was carried on from arm to arm, with human lymph. Vaccination with animal lymph was carried on in Bándra, Kurla, Igatpuri, Dhárwár, and Belgaum.

Taking together the work of all the Deputy Sanitary Commissioners, Superintendents of Vaccination, and Inspectors of Sanitation and Vaccination, there were 4,355 encampments, 81,618½ miles travelled in 8,584 days, and 319,386 children inspected in 12,964 villages. Out of every 100 persons operated on, 33·58 were this year inspected against 33·76 in the preceding year.

Inoculation was not reported to have been practised anywhere in the presidency, and no instances were reported of any disease having been communicated through vaccination.

In Bombay the Compulsory Vaccination Act has been in force for 11 years and in Karachi for 9 years, and in both places there has been since the introduction of the Act a considerable increase in the number of infants protected.

Sanitary Works—Military and Civil.

All available information under these sections has been thrown into tabular forms, and will be found in Appendices Nos. III. and IV. as directed in paragraph 5 of Government Resolution No. 3393, General Department, dated 28th September 1888.

Personal Proceedings and General Remarks.

I took over charge of the Sanitary Commissioner's office on 12th May 1888 from Deputy-Surgeon General Hewlett, C.I.E., whose tenure of the appointment expired on that date, and performed the duties of Deputy Sanitary Commissioner, Central Registration District, in addition to my own, till 18th June, when I was relieved by Surgeon Street, my successor in the latter appointment.

By Government Resolution in the General Department, No. 1906, dated 5th June, a committee was appointed to consider what means should be adopted for the removal of the nuisance caused by the Night-soil Depôt at Carnac Bandar, of which I was a member. Government were pleased to approve of the suggestions made in the joint report of the committee, which were as follow:—

"(*a*) The flushing arrangements being very inadequate, the existing reservoir should be raised and enlarged to hold a greater supply of water so as to propel the night-soil into the sewer at once."

"(*b*) The experiment of building a special ventilating shaft over the sewer outside the engine-room, at the bottom of which a gas-stove could be kept burning during the cold season (when north-east winds prevail) to cause a current of air to be drawn from the outside through the mouth of the sewer.

"(*c*) The old wall outside the entrance to the depôt to be removed, and trees planted in its place. A belt of trees should also be planted inside the Native Infantry Lines to the centre of the depôt. The Municipal Commissioner suggested that the wall in front of the depôt and separating it from the Native Infantry Lines should be raised so as to act as a screen and to prevent foul gases entering into the lines. The President and the Executive Engineer, Presidency, approved of this suggestion, but I preferred the planting of trees instead of this arrangement. The committee, however, saw no reason why both suggestions should not be carried out."

These measures are, of course, palliative, as the Municipal Commissioner held out no immediate hopes of the depôt being closed altogether. Sooner or later, however, the expansion of Bombay will compel the municipal authorities either to close or remove this depôt to some other locality.

In August I accompanied Mr. Filgate, Inspector-General of Prisons, and Dr. Salaman Superintendent of the Deccan Central Jail, to Godhra to report on a site for a Central jail for Gujarát. This was done in accordance with the instructions laid down by Government in the Judicial Department, No. 2871, dated 2nd June 1888. I spent the remainder of the rainy season in Poona, where several questions regarding the sanitation of the city and cantonment engaged my attention. The insanitary condition of the Night-soil Depôt was prominently brought to the notice of the Collector. The subject of sugar-cane cultivation in and around Poona was disposed of. The drainage question, both of the cantonment and city, was discussed with Mr. Whiting, the Superintending Engineer, Central Division. The subject of prickly-pear hedges around Government buildings engaged my attention. From a sanitary point of view such hedges are dangerous to health, as they harbour much filth which cannot be removed. Measures are being adopted to do away with this long existing evil as funds permit. Ghorpúrie barracks were inspected and reported on in compliance with the request of the Military Department.

In October I visited Thána, Mátunga, and Bandra for the purpose of selecting a site for a jail and lunatic asylum, and reported on the insanitary practice of burying the dead in churches and compounds at the latter place. I also visited Devlali and gave an opinion on the site of the cells and detention-rooms to be built there, as well as Násik and Málegaon, and reported on the water-supply of the former place, which Government noticed in Resolution No. 389, dated 30th January 1889. I visited Dhulia and reported on the gathering ground of the storage tank which I inspected with the Collector, Mr. Loch. Government Resolution in the Financial Department, No. 958, dated 12th March 1889, gives the municipality the necessary sanction to raise a loan for the purpose of constructing the water works.

In November I visited Bijápur, Bágalkot, Gadag, Hubli, Dhárwár, and Belgaum, and in December Sátára and Ahmednagar.

In January I proceeded to Sind and inspected Jacobabad, Shikárpur, Sukkur, Hyderabad, and Karáchi.

During February and part of March I was in Bombay, where the sanitary condition of the harbour and foreshore occupied my attention. I reported on this matter specially and suggested some practical measures of improvement.

In March I visited Gujarát and inspected the sanitary condition of Ahmedabad, Viramgám, Nadiád, Broach, and Surat. Defective drainage and conservancy arrangements are evils common to all the principal cities and towns visited. So long as such conditions exist they will account for the prevalence of disease and a high rate of mortality, a large portion of which is preventable by practical means. This is proved conclusively by the well nigh total disappearance of epidemic disease in England owing to the progress of sanitation and also the reduction in the mortality of the British army from 69 to 12 or 14 per 1,000. Results such as these should stimulate and encourage sanitarians in their struggles against ignorance, prejudice, and apathy, and they must continue to reiterate the principles of hygiene until at last the mass of the people understand the vital necessity of living on unpolluted soil, breathing fresh air, and drinking pure water.

The study of sanitation by officers of the Civil Service as part of their curriculum at home would be an important reform, as they would in the course of their Indian career be in a position to put the value of its precepts to a practical test. General instruction in hygiene in schools and the delivery of popular lectures would tend to the formation of public opinion on the subject, which at present does not exist. It is hoped that in the near future municipal authorities will interest themselves more in the sanitary condition of their towns. At present, with a very few exceptions, they seem unable or unwilling to cope with the difficulties of the subject, and are looking for someone to lead the way and set an example in the sanitary improvement of cities and towns.

Absence of progress in sanitary matters means retrogression. An energetic and defined sanitary organization is urgently needed, especially for the protection of drinking water, which is a common gift to all men.

Authoritative interference is absolutely necessary to prevent individuals abusing and contaminating potable water, but such interference need not exceed the principles of enlightened legislation. The prime object is to get rid of, or mitigate the ravages of, epidemic cholera, the presence of which is evidence of a violated law and cannot, as a rule, be limited by private effort.

Sanitary reform can only be effected by three methods :—

1*st.* Voluntary individual action.

2*nd.* Local communities represented by municipalities.

3*rd.* Central authority, or Government.

The first is the best mode if the individual is able and willing to execute the necessary improvement; if not, the duty devolves on the second agency, viz., municipalities, which, with a few exceptions, in my experience are unwilling or unequal to the task of putting their houses in order in a sanitary respect. As municipalities are on the whole incompetent to deal with problems of sanitation, the responsibility can only rest with Government; and as this is the only reasonable solution of the question, the sooner it is acknowledged and action taken in the matter the better it will be for the health and prosperity of the public.

A good deal of the work to be done lies no doubt within the sphere of instruction and advice, and beyond that of authority and command, which at first, however, ought to go hand in hand. As education advances authority will give place to instruction in the evils that affect the public health, the root of which is generally ignorance. Exposure of sanitary shortcomings in detail must prove a lesson to sufferers as well as to those who may be to blame, and a wide diffusion and knowledge of the elements of the laws of health will, it is firmly believed, save many of the people from "perishing for lack of knowledge."

Much unnecessary expenditure is incurred by municipalities in burning sulphur and dammer in the open air during cholera outbreaks. It is literally throwing money to the winds burning such materials in the open streets and lanes. It would be better to clean out the plague spots which exist in every town and village.

The Health Officer of the Port has submitted a full and interesting report. The following table gives a summary of the shipping and health of the port and of the Health Officer's work:—

Vessels.	Number.	Number of Crews and Passengers.	Number of Vessels inspected.	Number of Persons inspected.	Number of Vessels disinfected.	Number of Persons vaccinated.	Infectious Diseases.				Cattle and Equine Disease.	Insanitary Cargo.
							Cholera.	Small-pox.	Measles.	Scarlatina.		
Entered - -	59,573	379,112½	19	19,750	10	686	28	11	37	—	6	—
Left - - -	45,108	358,863½	673	77,007	4	—	—	9	—	—	—	—
Harbour craft and population - -	1,615	24,887	25	Unknown.	25	—	23	5	1	—	—	—
Total - -	106,296	762,863	717	96,757	39	686	51	25	38	—	6	—

Ten vessels on board of which diseases of an infectious nature actually existed at the time of arrival were inspected. This number also includes vessels with cattle-disease, which were disinfected.

One of the principal improvements to be noted in connexion with the sanitation of the Port has reference to the improved system under which measures of disinfection ordered by the Health Officer of the port are carried out. At my request, Government in their Resolution in the Judicial Department, No. 2834, dated 1st June 1888, sanctioned that the Water Police should superintend the disinfection of vessels, which has added greatly to the efficiency of the protective measures in force.

There are no proper rules for the protection of the Port against the importation of infectious disease. The only safeguard has been the pilots, but as these officials boarded only 1,072 vessels out of the total number of 59,573 that arrived (no vessels of under 200 tons being required to take a pilot), it will be seen that the protection afforded by them was very small indeed. Moreover, the rules for the guidance of pilots in this matter are so out of harmony with Act VI. of 1867 and so wanting in clearness and precision that they have very little force. The Health Officer made certain suggestions for the better protection of the Port against the importation of infectious diseases, which were submitted to Government, who were pleased to appoint a Committee in consultation with the Health Officer to consider and report on his recommendations. Government approved of the Committee's report with the exception of the appointment of an assistant to the Health Officer. The committee is still engaged in drawing up a new set of quarantine regulations in accordance with Act VI. of 1867.

The total number of vessels inspected on leaving was 673 as compared with 732 last year, and of these 111 were re-inspected, 11 twice, 3 thrice, 2 four times, 1 five times, and 1 twelve times. The causes necessitating re-inspection were unconnected with any insanitary or unhealthy state.

Unlike what obtains at most other ports in the world, the principal work of the Health Officer is in connexion with outgoing vessels, the exportation rather than the importation of disease being that which is most guarded against in Bombay.

All vessels sailing to Europe *viâ* the Suez Canal, Red Sea ports, Persian Gulf ports, Mauritius, and Zanzibar *viâ* Aden, are, after inspection (all inspections are personally made by the Health Officer), furnished with a special form of bill of health introduced from the beginning of the year, which not only certifies as to the health of the city and suburbs, as is usual in all documents of the kind, but testifies in a special manner to the health of every person on board as well as to the satisfactory sanitary condition of the vessel at the time of her departure.

The total number of bills of health issued were 1,115, but as the number of departures from the port during the year was 45,108 it follows that 43,993 vessels sailed without taking any bills of health. The majority of these, however, consisted of native passenger steamers and sailing crafts, many of them making several departures the same day to stations on the neighbouring coast.

I have specially brought to the notice of Government the danger to the public health from the filthy condition of the foreshore of Bombay Harbour, and suggested a few practical remedies for improving it. The offensive sights and smells must be seen and felt at low water to be believed. Division of responsibility between the Port Trust and Municipality is, I believe, accountable for this defective sanitary state, which is a most hideous blot on our magnificent harbour.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1888-89.

(Sir H. L. Harrison, Chairman.)

Town Improvement.—It will be seen from the annual report of 1887-88 that the amount available for bustee and structural improvements for 1888-89 was Rs. 2,61,780-3-11. To this the usual allotment of a lakh and a half, besides Rs. 30,000 for petty town improvements, was made from revenue, but of this sum Rs. 1,45,933 were assigned for paying the interest on loans raised in 1886-87 and 1887-88 and the bustee cleansing establishment. Accordingly, the funds available for the year amounted to Rs. 2,95,847-3-11.

This sum was thought quite adequate for the year, looking to the few large bustees which remain unimproved, and therefore it was resolved not to borrow the third instalment of the loan to complete the sanctioned grant of 8 lakhs on account of bustee and other sanitary improvements during the year, *vide* the Resolutions of the Bustee Committee at their meeting held on the 31st May 1888.

The sum available was Rs. 2,95,847-3-11. The expenditure actually incurred and adjusted in the accounts has been Rs. 2,61,27-41-7.

Bustee improvements.—The following statement shows at a glance the stages arrived at up to the close of the year in each of the bustees which were being dealt with under the provisions of sections 280-283 :—

Improvements completed.

(1.) Rajbullabpara Bustee.
(2.) Moydaputty Bustee.
(3.) Soorhatta Bustee.
(4.) Ooryapara Bustee.

Improvements nearly completed.

(5.) Goabagan Bustee.
(6.) Moonsheetalao Bustee.

Improvements commenced.

(7.) Moydatolly Bustee.
(8.) Bustee north of Manick Bose's Ghat Street.
(9.) Bustee south of Manick Bose's Ghat Street.
(10.) No. 2 Bonomally Sircar's Street Bustee.

Projects finally approved but works not commenced.

(11.) Machooa Bazar Bustee.
(12.) Raja Bagan Bustee.

Improvements finally considered.

(13.) Nundon Bagan Bustee.
(14.) Mothoor Sen's Foolbagan Bustee.
(15.) Coomartolly Bustee.
(16.) Chinapara Bustee.
(17.) Ahireetollah Bustee.

Report of the medical officers and objections from the owners considered.

(18.) Maugpara Bustee.
(19.) Hareepara Bustee.

Report of the medical officers before the Bustee Committee.

(20.) Blocks of bustees in Hastings.
(21.) Radha Mullick's Bagan Bustee.
(22.) Komedan Bagan Bustee.

The improvements required to be carried out in the Shaikpara Bustee have all been completed, the owner of the largest block having made over land for the roads free of cost. The land required for the bathing platform and latrine was acquired and paid for.

Tank filling and bathing platforms.—Thirty-four tanks were taken up during the year, of which 15 were filled up by the owners and 18 by the Corporation and 1

dewatered. No further progress was made during the year in putting up additional bathing platforms, but the Commissioners decided to put up 4 more in wards 2 and 7. They will be completed during the year.

Street improvements.—The grant on this account from revenue was Rs. 30,000. This is for petty improvements only; all larger and more important constructions are undertaken from the drainage budget. These improvements are, of course, also independent of all works carried out as bustee improvements. The expenditure incurred on this account, as adjusted during the year, was Rs. 24,533-5-1.

Water-works.—The most important work of the year has been the completion of the water-works extension, by which the full contemplated supply of 16 million gallons has been given to the town within its old limits. As the preliminary chapter of the report has been devoted to a description of this project, it is only necessary in this part to recapitulate the results very briefly. As long as the new 48-inch main was not laid, it was impossible for the supply to exceed $8\frac{1}{4}$ millions per diem, and accordingly the average supply was 8,207,330 in 1884–85, and 8,106,515 in 1885–86. After this main was laid the new works came into operation gradually, and the averages have risen year by year to—

9,116,847	gallons daily	in 1886–87
10,330,525	„	„ 1887–88
12,256,351	„	„ 1888–89

The Halliday Street Pumping Station opened in the last week of January, and the average supply in February rose to 14,321,285, and in March to 15,210,790. Since the close of the year the full 16 million gallons have been regularly given, and the riparian wards are once more in receipt of an abundant water supply.

Of the area newly added to the municipality, the portion lying east of the town is to be supplied from the main running down Circular Road, while it has been decided that it will be necessary to have a new pumping station for the large area lying to the south of the town. No progress, therefore, can be made in supplying the latter area with water except by increasing the number of standposts along Lower Circular Road, but the eastern area can be supplied at once, and this has been done very expeditiously, no less than 10 miles of piping having been laid down outside the old limits before the close of the year under report, while the whole $21\frac{1}{2}$ miles have since been put down.

It is premature to give any actual figures of the cost of filtered water as the interest of the whole of the works was being paid for in 1888–89, while only three-fourths of the supply was being given, but judging from the budget of the current year the cost of the water to the city *after* distribution will be a lakh per annum for every two million gallons delivered daily. This means As. 2·19 per 1,000 gallons.

As one result of the augmented supply it was found feasible to increase the numbers of standposts in the town from 567 to 758.

The unfiltered supply during the year has been very good, and excellent pressure has been maintained, as a consequence of which the daily average supply increased from 2,501,830 gallons to 2,881,842. On the occurrence of a fire within reach of the unfiltered water, the pressure is such as to enable the pipes to carry water to the tops of the highest houses without the intervention of any fire engine. Unfiltered water is now frequently substituted for filtered in connected privies, but the Engineer is very apprehensive lest the increase of these connexions should eventually materially diminish the pressure. The present cost of the unfiltered water is about one-third of the filtered supply, or As. 0·7 per 1,000 gallons.

Drainage.—The drainage works of the town are virtually completed. The area north of Baug Bazar, which was left out of the ordinary drainage works in consequence of its low level, has now been sewered, but it has been necessary to carry the sewers at such a level as to leave some of the lowest tracts below them. This can only be remedied by raising the level of these lands, which is being done. Another area called Potuatollah, in Ward No. 9, containing several acres of small tanks and undrained land, has also been pierced with roads and sewers, and one or two minor streets in other wards also piped. Altogether—

4,198	feet of sewering has been done in Ward No. 1 (Baug Bazar).
3,103	„ „ „ Ward No. 9 (Potuatolla Street).
4,363	„ in all the other wards of the town.
11,664	

Some work, however, still requires to be done in the direction of improving the flushing of the sewers, and providing them with the new form of manhole covers in ventilating them, and above all in laying down kerb and channel stones in some of the more important streets in which they are wanting. Much was done in this direction during the year, and the Engineer has subsequently submitted a completion estimate amounting to nearly 9 lakhs, which is under the consideration of the Commissioners.

For drainage purposes the added area should be divided into three portions, the area west and south of Tolly's Nullah, which includes the new docks, and which drains towards the south and south-west, the area east of Tolly's Nullah, including Balligunge and Entally, which drains towards the Bidyadhari, and the area included between the Circular Canal, Circular Road, and the Eastern Bengal Railway, which has no drainage at all except into the municipal system of drains. This last area, which is indefinitely the smallest, covers less than a square mile of ground, and a scheme for its drainage, estimated to cost 17 lakhs, has long been before the Commissioners. It was originally proposed to execute the work under section 168, Act IV. (B. C.) 1876, by which a special drainage rate of 2½ per cent. can be levied in return for the work done (*vide* section 88), but when it was found that the special drainage rate would realise about Rs. 10,000 per annum, or less than 1 per cent. on the outlay, the Commissioners declined to sanction the work. It is now again before the Commissioners, but the same difficulty is felt, viz., that it is so large an outlay for so small an area. The Engineer, however, maintains that this area, shut in as it is, cannot be drained in any other way.

As regards the drainage of the other two areas, it is hoped that they will not be proportionately as expensive; but before any steps can be safely taken, a survey of levels is indispensably necessary; this has accordingly been sanctioned.

The year under report furnishes stronger evidence than ever of the necessity of continuously inspecting house connexions. In 2,757 out of the 5,603 premises examined during the year a defect of some kind or other was found.

Roads and Sewer Maintenance.—The roadway of the old area may be thus summarised:—

	Miles.
1st class roads, *i.e.*, from 32 feet in breadth, upwards	28·8
2nd do. 15 to 31 feet	61·5
3rd do. 9 to 15 „	41·7
4th do. less than 9 feet	17·4
Paths over and sewered ditches	34·9
	184·3

The total cost of maintaining these roads in 1888–89 was Rs. 1,72,031. Of the above streets 93·3 miles, *i.e.*, all the 1st and 2nd and a few of the 3rd class streets, are regularly watered; 14·87 miles of the roadway are laid with tram rails, which continue to receive the constant attention of the department owing to their bad state of repairs. During the year under report no less than 113 notices to repair were served on the Tramway Co.

The total length of sewers in the town that had to be maintained and kept in order by the road department at the close of the year was 37·3 miles of brick sewers and 140·3 miles of pipe sewers. The arrangements for cleaning and flushing these have been much improved during the last few years, and during the year under report each brick sewer was cleaned out on an average 10 times and each pipe sewer 25 times. The five river penstocks which flush the five main sewers were raised on an average three times a week.

Sanitation.—Birth registration shows continuous improvement under the new system of making the town inspectors registrars of births and deaths. The number of births recorded was 8,643, being 19·9 per 1,000 as against the decennial mean of 17·4. As has often been pointed out, it is not easy to ascertain to what extent this is deficient, owing to the comparatively small female residential population. The increase in the percentage may be due to an increase in the number of residents as well as to better registration. The total mortality was 11,685, giving a death-rate of 26·9 as against 28·7, the decennial mean. Last year the rate was 25·3, so that the year under report shows an increase of 1·6 as contrasted with the preceding year.

The mortality from fever fell to 3,198 against a decennial mean of 3,963. The mortality this year is the lowest on record under this head.

The remarks of the Health Officer regarding underground drainage in bustees will receive the most careful attention of the Commissioners. It is, perhaps, to be regretted that Dr. Simpson never had an opportunity of seeing the bustees of Calcutta before they were sewered; it was then the general impression that the foul open drains which seamed them in every direction were as deleterious to health as they were undoubtedly offensive to sight and smell; at the same time it is also undoubtedly the case that owners of bustees cannot be relied on to keep the sewers constructed by them properly attended to or flushed. The Engineer has, therefore, been requested in future to prefer open drains, or drains temporarily covered over, as suggested by the Health Officer, in completing the drainage of such bustees as have not already been sufficiently sewered.

The year under report has been on the whole a bad year for cholera, the mortality having been 1,734 as against the decennial mean of 1,611.

The deaths from bowel complaints aggregated 1,056 as against 1,436 the decennial mean.

Few as the deaths from small-pox were the mortality of the year still showed that the minimum period has passed, and that a maximum or pre-maximum year may be expected in 1890. The last maximum was in 1884, when there were 478 deaths, a very low maximum. Since then the figures have been—

1884 - - -	478	1887 - -	2
1885 - - -	155	1888 - -	12
1886 - - -	15	and in 1889 (6 months) -	49

It is interesting to watch the unerring periodicity of this malady in Calcutta. Attention to vaccination, no doubt, influences greatly the extent of the mortality, but the periodical ebb and flood remains unaffected by it.

The mortality from other causes was 5,685 against 5,115, the decennial mean.

(The remainder of the report is mainly taken up with a criticism of the Health Officer's remarks in regard to fever and the remedial measures necessary to check its prevalence. While acknowledging that these remarks are made with the best possible motive, viz., an earnest desire to improve the sanitary condition of the town, the Commissioners think that sufficient account is not taken of the sanitary improvements which have been already carried out. In connexion with the Health Officer's remarks on overcrowding they call attention to the recent passing of an Act which will give the Commissioners power to prevent this evil in the case of buildings over which they heretofore had no control.)

ABSTRACT OF THE HEALTH OFFICER OF CALCUTTA FOR 1888.

(*Dr. W. J. Simpson.*)

The birth registration appears to have been fairly satisfactory throughout the year. The number of births amounted to 8,643 against 7,954 and 7,827 in the two preceding years. The birth-rate was equal to 19·9 per 1,000, which is the highest in the decennium against 17·4, the mean of the decade. The birth-rate was highest among the mixed races, and lowest among non-Asiatics, being respectively 46·6 and 14·7 per 1,000 of the population.

The general mortality was comparatively low, though somewhat higher than the two preceding years. It was under the mean of the decade, and occupied a fourth place in the decennium, six years having a higher mortality. The figures are as follows:—

1878.	1879.	1880.	1881.	1882	1883.	1884.	1885.	1886.	1887.	1888.
36·6	29·1	25·8	28·9	29·2	27·2	29·2	29·3	26·4	25·3	26·9

The number of deaths amounted to 11,685, which gives an annual death-rate of 26·9 against a decennial mean of 28·7. A comparison of the death-rate of each ward, with each of their decennial mean death-rates, shows that there has been a decline in the death-rate of all the wards except two. The two at fault are Jorabagan* and Colootollah, both exceedingly filthy and overcrowded; their death-rates were respectively 33·0 and 39·2.

The mixed races, as usual, exhibited the highest death-rate, dying at the rate of 32·9 per 1,000. Hindoos followed at the rate of 28·7, and Mahomedans at 24·0 per 1,000 of the population. The proportion of females to males was as 33 to 23; the highest mortality occurring among Hindoo females, whose annual rate was 33·2 per 1,000.

Infants under one year of age had a higher rate of mortality in 1888 than in the two preceding years. Their death-rate was equal to 413·9 per 1,000 of the population against 404·1 and 398·5 in 1886 and 1887. The ratios estimated on the births were 292·2, 287·7, and 284·6 respectively.

A comparison between the death-rate of the town and that of the suburbs shows that in 1888 the suburban death-rate was 42·5 per 1,000 of the population, against a death-rate of 26·9 per 1,000 in the town.

Fevers

The fever mortality in 1888 was the lowest that has been recorded. The number of deaths amounted to 3,198 against a decennial mean of 3,963. This continuous decline of fevers would be a source of congratulation were it not accompanied by a rise in the number of deaths from other causes, and it becomes a question whether it is not a mere change in name, and that which was formerly classed under the general name fever has been now transferred to more special causes, in consequence of better powers of diagnosis on the part of medical attendants in Calcutta, who are also more numerous now than formerly.

* Since the above was printed, it has been discovered that an error has been made in the compilation, and that a large number of deaths, 181 for Jorabagan and 507 for Colootollah, which occurred in the hospitals in these wards, but had no definite address, and which should, therefore, have been placed by themselves, have been included in the death statistics of the two wards. With these numbers deducted the death-rate of Jorabagan is 28·1, and that of Colootollah 28·5.

Statement showing the Number of Deaths from the five principal Diseases from the years 1865 to 1888.

Deaths in	Fever.	Cholera.	Dysentery and Diarrhœa.	Small-pox.	Other Causes.	Grand Total.	Annual Ratio per 1,000 of Population.
1865	5,402	5,078	3,315	4,923	4,524	23,242	54·1
1866	5,497	6,826	3,809	83	4,068	20,283	47·2
1867	3,845	2,270	2,398	30	3,554	12,097	28·1
1868	3,681	4,186	2,414	43	3,409	13,733	31·9
1869	3,833	3,582	2,000	39	3,289	12,743	29·6
1870	3,577	1,558	1,699	150	3,417	10,401	24·2
1871	4,242	796	1,488	33	3,730	10,289	23·9
1872	4,895	1,102	1,365	18	2,972	10,352	24·1
1873	4,632	1,105	1,361	33	3,235	10,356	24·1
1874	4,461	1,245	1,358	120	4,343	11,527	26·8
1875	5,328	1,674	1,579	720	4,785	14,086	32·7
1876	4,361	1,851	1,864	71	4,817	12,964	30·1
1877	5,151	1,418	1,683	67	5,385	13,704	31 9
1878	6,086	1,338	2,010	1,495	5,467	16,396	38·1
1879	4,796	1,186	1,516	772	4,774	13,044	30·3
1880	3,797	805	1,267	114	5,698	11,681	27·1
1881	3,765	1,693	1,491	133	5,948	13,030	30·0
1882	3,618	2,240	1,454	17	5,848	13,177	31·4
1883	3,442	2,037	1,307	73	5,466	12,325	28·4
1884	3,618	2,072	1,209	478	5,879	13,256	30·5
1885	3,831	1,603	1,655	155	5,463	12,707	29·3
1886	3,422	1,741	1,258	15	5,011	11,447	26·4
1887	3,253	1,198	1,197	2	5,329	10,979	25·3
1888	3,198	1,734	1,056	12	5,685	11,685	26·9

From the table it would appear that in recent years, as compared with some of the previous years, there has been a marked decline in the numbers under the head of fever, though if the years 1867, 1868, 1869, and 1870 are taken into account, the decrease, except within the last two or three years, has been exceedingly small. What strikes one is the large number of deaths from fever in the years 1875, 1876, 1877, and 1878, a circumstance, however, explained by the fact that Calcutta like other parts of Bengal suffered from the epidemic of fever which went under the name of the Burdwan fever.

Another point in connexion with the study of these fever statistics is that, except by well-educated medical men, fever is a generic term used in India to denote almost any disease accompanied by feverishness, heat of skin, thirst, &c. If a man dies of some internal or visceral complaint, the feverishness of the body is sufficient to cause his friends to register the death as fever. This is gradually changing as increasing numbers of educated native medical men from the University of Calcutta are settling down into practice in Calcutta, and, as a consequence, a large number of deaths which would formerly have been classed under the generic term fever are being transferred to more special causes which come under the head of "other causes." Now, if the number of deaths under the heading of other causes be examined, the opposite process to that occurring under the title of fever will be observed to be going on. The deaths have increased very considerably in numbers since 1880 above what they were in the previous years.

If then the deaths from fevers and the deaths from "other causes" be combined, and the reason of the excessive fatality in the years 1875, 1876, 1877, 1878, and 1879 be borne in mind, and the slight increase in population in later years not forgotten, the decline in fevers has a very doubtful existence.

The figures are as follows:—

Years.	Deaths.	Years.	Deaths.	Years.	Deaths.	Years.	Deaths.
1865	9,926	1871	7,972	1877	10,536	1883	8,908
1866	9,565	1872	7,868	1878	11,553	1884	9,497
1867	7,399	1873	7,867	1879	9,570	1885	9,294
1868	7,090	1874	8,804	1880	9,495	1886	8,433
1869	7,122	1875	10,113	1881	9,713	1887	8,582
1870	6,994	1876	9,178	1882	9,466	1888	8,883

Of course, objection may be taken to the figures; the statistics may be wrong, most probably they are. My own opinion, expressed soon after my arrival in Calcutta, that the statistics were unreliable is still unchanged, but taking them as they are, the decline in fever mortality when analysed is not so marked as to justify much congratulation on the improvement of the public health. There may be a considerable decline in the fevers, but with the statistics at hand there is no way of proving this. But should it be granted that the inhabitants do not die so frequently of fever as in former years, it must also be granted that in place of fever they die of other causes at a greater rate than formerly.

I have been led to make the following remarks, because it seems to be the impression that drainage mainly consists in laying down a large number of pipes irrespective of a consideration of the nature of the locality, which may be densely crowded with buildings constructed on most irregular lines, and by their irregularity rendering effective drainage almost an impossibility. The pushing on of underground drainage under these circumstances is but a doubtful improvement. It may improve the appearance of the locality, but it is very questionable whether it improves the public health. Then, in regard to bustees, with the exception of those which have lately been improved, by having good wide roads run through them before any drainage has been laid down, the introduction of underground drains is liable to be a source of ill-health to the inhabitants. During the year I have inspected all the bustees in town, and in nearly all those which have been drained by the owner, I have been struck with the impurity of the air due to offensive emanations from the drains. Scarcely a drain is flushed, nor are there any means of flushing them, consequently, though they are efficient enough in carrying away to the larger sewers much of that which causes an undrained bustee in the rains to look so filthy, yet their own condition underground is such as to be deleterious to health and dangerous to those who inhale the gases. I trust that no underground drains shall be laid down in the suburbs before wide roads and streets on a comprehensive plan are arranged for, and that any scheme of drainage entertained shall not include bustees until they have been improved by good broad roads run through them. For, the greater my experience of the effects of the network of underground drains in bustees, the greater is my distrust of their utility and freedom from danger.

It appears to me that it would be safer and more conducive to the health of the bustees to restrict underground drains to the broad roads which should intersect every bustee. All other tributary drains should be open, or if surface drains should prove inconvenient in some places, then the greater portion of each tributary drain should be covered with moveable open iron gratings. This arrangement would ensure the condition of the drain being readily seen by inspection, and consequently secure greater cleanliness, while at the same time the drain being exposed to the influence of the sun and air injurious sewer gases would not be elaborated.

Again, in a large drainage scheme there is another danger to which it is necessary to draw attention. Care should be taken not to obstruct the natural drainage of the area to be operated upon, and if this should be unavoidable, as it must necessarily be in many low-lying districts, then provision should be made by separate sub-soil drains to carry away the sub-soil water, which otherwise gets pent up and gives rise to disease. Though the newly introduced sewers may work efficiently enough and carry away the sewage discharged into them, yet they may not have any effect in reducing the level of the sub-soil water. An example of this kind may be seen at Baug Bazar in Calcutta. There a network of new roads has been constructed higher than the surrounding locality. In the new road, sewers have been placed which are also higher than the surrounding locality, while no provision has been made for carrying off the sub-soil water. The roads, being unprovided with underground culverts, have blocked up the natural drainage of the area, converting the district into so many tanks, the effect being that, during the rainy season, huts which were formerly comparatively dry almost float in the pent-up floods. The raising with silt from the adjacent canal of the huts and low-lying ground has lessened to some extent the marshy and flooded appearance of some parts of the area, but even with this raised land and no appearance of floods, it must be borne in mind that the natural drainage is obstructed, that the flow of the sub-soil water is impeded, and that conditions, though not visible, are still present which will in the future cause ill-health in the locality.

The cholera mortality in 1888 exceeded the decennial mean by 123. The number of registered deaths amounted to 1,734 against 1,611, the average number of the decade. The number of deaths in each quarter was as follows:— Cholera.

1st quarter.	2nd quarter.	3rd quarter.	4th quarter.	Total.
541	514	162	517	1,734

The causes of its prevalence were sufficiently set out in my quarterly report for June, which created at the time some discussion. The scarcity of water then referred to has now been remedied, the new pumping station at Halliday Street having been brought into operation on the 28th of January 1889. Two engines began work on that date, and about one million gallons were distributed to the riparian wards where the scarcity had been most felt. About the middle of February two more engines were added, and the four now distribute four million gallons of water during the six hours they are working, viz., between 6 a.m. and 10 a.m. and again between 3 and 5 p.m.; with the extra supply from Tallah water can now be obtained from the standposts for 12 to 13 hours in the day.

Some of the other causes referred to still exist. They are difficult to deal with, demolition of the unhealthy areas and then rigorous enforcement of proper building laws being about the only remedy. In my report of 1887 I dwelt on the unhealthiness of the close, narrow, and ill-ventilated streets in the riparian district, giving a map showing proposals which would rectify the condition of matters. Every year's delay in carrying out the construction of broad streets in these localities brings with it greater difficulties and expense. Even during the three years I have been in Calcutta, I have seen a marked change going on. The crowding together of houses is becoming greater, the open spaces are being more encroached upon, the breathing space is gradually contracting, and the localities are progressively attaining a more unhealthy state. Neither drainage nor water-supply will make up for want of fresh air. Bad air is as unwholesome as bad water. Crowding together of houses means overcrowding of the inhabitants. Great density of population on a limited space is inevitably attended with great impurity of the air and marked insanitary conditions. A limit must be placed on the number of houses built on a given area of land if the public health is to be maintained. Should radical measures not be taken to counteract the forces which are active in causing the air of numerous localities in the city to become more deteriorated every year, then in spite of a good water-supply and notwithstanding an expensive drainage system, the Commissioners must be prepared to see certain parts of the town becoming more unhealthy year by year. The policy at present pursued of constructing narrow lanes and rounding off corners here and there under the name of improvements does not improve the public health. It increases the value of property, but at the same time favours overcrowding, and is injurious to the sanitary and best interests of the town. I may here repeat what I have mentioned in former reports that a comprehensive plan of proposed new streets is one of the first essentials to the carrying out of improvement in the town and suburbs.

Deaths from dysentery and diarrhœa numbered 1,056 in 1888 against 1,436, the decennial mean. Bowel complaints.

The deaths from causes other than those included under the distinctive heads of cholera, bowel complaints, fevers, and small-pox amounted to 5,685 against a decennial mean of 5,115. Other causes

The number of deaths from small-pox amounted to 12 against a decennial mean of 325. During 1887 the town enjoyed an unusual immunity from small-pox which, with the exception of a few cases in March and April of 1888 in Hastings, continued until June 1888. In the beginning of that month a girl of three years affected with the disease arrived in Calcutta from Lucknow. She was taken to 69, Cross Street in Burra Bazar, and in this crowded bustee she lay ill. She had never been vaccinated. The disease attacked a seven months' child in the same house and spread to the neighbouring houses. Seven persons were attacked before the existence of the disease was known to the Health Department. The police on the 1st of July accidentally found Small-pox.

a child in a convalescent state playing outside one of the houses, and immediately reported it to the Deputy Superintendent of Vaccination, who, on making inquiries, found six other cases in the neighbourhood. After active measures had been taken, only two other cases occurred in that locality; both patients were unprotected. It, however, broke out at the Mahomedan mosque at 98, Chitpore Road, and from there spread to the mosque at 19, Machooa Bazar Street. In August it attacked some of the inhabitants in the neighbourhood of the mosque. On the 20th September the S.S. "Thisbe" arrived in port from Jedda with small-pox cases on board. The Health Officer of the Port arranged that the rest of the crew should be vaccinated before they left the vessel. The infected cases were sent to hospital, and the vessel was disinfected. Some of the crew took up their abode in Taltollah, and a case occurred there soon after, but no direct communication was traced between the patient and the crew of the infected ship. No cases occurred in October, but towards the close of November a case was imported from Patna. The patient was a Mahomedan girl, aged 1½ years, and was unprotected. Two other cases occurred in December.

Vaccination

The total number vaccinated during the year amounted to 10,584, of these 9,648 were primary and 936 were re-vaccinations. The corresponding figures of the previous year were 9,616 and 931 respectively. Of the 9,648 primary, 8,166 were successful, 488 were unsuccessful, 100 were doubtful, and in 894 cases the result was not ascertained. Of the 936 re-vaccinations 106 were successful, 423 were unsuccessful, 203 doubtful, and in 204 cases the result was not ascertained. The rate of success in primary and re-vaccination has been 84·63 and 11·32 respectively. The corresponding figures of the previous year were 87·05 and 10·52 respectively. The decrease in the rate of success in primary vaccination is due partly to some cases proving doubtful during the hot weather and partly to the result of a large number of cases not being ascertained.

In Calcutta both the humanised and animal virus was kept up by regular transmission and used all the year round. Like the previous year the operations, with both varieties of lymph during the commencement of the hot weather, were followed by a large number of doubtful and unsuccessful cases, nothwithstanding greater care in the selection of the lymph.

As reported in previous reports, vaccination is systematically carried on in all sections of the town, but the extent of protection of each ward varies with the nature of its population. The section or ward inhabited by Europeans and resident Bengalees are better protected than those inhabited by up-country people. The Vaccination Act has, however, been of great help in dealing with the prejudices of these up-country men, so that scarcely a year passes in which vaccination is not introduced in several new families amongst Khettrees and Marwarees.

The Vaccination Act was systematically carried out during the year under report. The vaccinators made regular house-to-house inquiry in their respective wards, and where unprotected children over one year were found notices were served on the parents or guardians to have them vaccinated within 15 days. During the year about 2,500 notices were served in this way. Most of these men complied with the law on receipt of the notice, but 454 had to be prosecuted for neglect to do so. The registrars of births also submitted in monthly statements the names of 6,215 persons who failed to produce the statutory certificates of having had their children vaccinated. These cases were inquired into by the department with the following results:—3,876 were traced and vaccinated, 873 were found to have left town, 303 could not be traced, 318 were dead, 467 were ill, and 378 were prosecuted, and, with the exception of those who produced medical certificates or left town before the day of trial, were vaccinated by the order of magistrates.

ABSTRACT OF REPORT OF THE BOMBAY MUNICIPALITY FOR 1888-89.

(Mr. E. C. K. Ollivant, C.I.E., Municipal Commissioner.)

Drainage.—The most important works in progress were the erection of ventilating shafts in various districts; the completion (departmentally) of the Khetwadi house connexions; the progress of the pipe sewers and house connexion work in the Queen's Road district; new branch sewers in Bellasis Road, Foras Road, and Gilder Street; surveys (completed) for house connexions in a large portion of the Agripada district; surveys (completed) of the entire sewerage of Colaba, and surveys (in progress) for pipe sewers and ovoid sewers in Umarkhadi, Bhuleshwar, Kharatalao, Tarwady, Mazagon, Byculla, Chinchpogli, and Parel districts. Any special comments on these various works will find a more fitting place when these several reports are presented. Any general remarks as to the necessity of providing proper sewers for undrained or ill-drained districts must needs be a mere repetition of what I have said on so many previous occasions. I fully concur in the observations made by Mr. Charles last year in this branch of his report, and I beg the Corporation to remember that, apart from the evils inherent to a want of systematic sewerage, there is an ever-increasing risk of disaster from allowing, even as an inevitable temporary expedient, the new sewers and the new pumping machinery to be applied to a purpose which they were never designed to serve. The rapid extension of buildings makes the sewerage of the northern districts a matter of pressing importance, and no time should be lost in arriving at a definite conclusion as to the best sewage outfall for those districts. Public works.

Water-works.—*Tansa.*—Good progress was made with the dam works, the out-turn of the year representing a value of Rs. 6,80,105-0-2 as compared with Rs. 4,61,510-9-4 in the preceding year. The excavations for foundations still continue to give trouble owing to considerable faults being met with, and the estimate on this account will be exceeded. At the end of the year the greater part of the dam across the river bed had been raised to R. L. 364, the final level being R. L. 408 for project as now being carried out, capable of being raised to R. L. 425 at any future time.

Notwithstanding many difficulties—amongst which I regret to have to include the death from exposure and hard work of Mr. James, one of the most active members of the firm—the progress on the duct works has been fair; the work done during the year representing a value of Rs. 11,50,000 for pipe-laying only. The total length of tunnelling executed during the year was 4,800 lineal feet. Bassein Creek Bridges, Nos. 1 and 3, consisting of four spans each, have been completed; four miles of the 48" main on Siphon Track, No. 6, were laid and jointed.

The greater part of the land required for the lake and duct has been acquired, certain properties in the Island of Salsette remain to be settled for, and the land for the pipe line from Ghatkupar into Bombay still has to be acquired. The progress which has been made up to the close of the year in the several main branches of the work is approximately represented as follows:—

Conduit and tunnels.	Dam.	Pipe-laying.	Bridges.
·3	·4	·5	·8

Vehar.—The rainfall for the year was 76·71 inches, the average for the preceding 27 years being 81·59 inches. The rainfall was not of a character favourable to a large percentage collection in the lake, and on the 31st October 1888 the water level was only at 257·15 T. H. D., the level at which the water overflows being 262·50 T. H. D. The first section of the work of replacing the puddle trench in the waste weir was completed. The object of this work is to stop the leakage of 1,250,000 gallons per day, which took place when the lake was full. Although the water in the lake failed to rise to the levels where the heaviest leakage took place, the gaugings show that the work done has materially reduced the leakage. The second section of the work remains to be completed.

The following other works were completed during the year:—Repitching and repairing of Dam No. 2. Chawl for workmen. Catch-water channels. A site near the existing filters was surveyed and contoured with a view to the extension of the filter beds. The bungalow is being thoroughly repaired, and rooms have been erected over several sluice houses along the line of pipe.

Tulsi.—The rainfall for the year was 89·08 inches, being about an average one. The lake was filled on the 21st August 1888, but as the close of the monsoon was a very light one, the lake was on the 31st October 1888 one foot lower than on the 31st October 1887. This difference was gradually reduced by the supply to the city being restricted by about 20 per cent., and the height of the lake was the same on the 31st March 1889 as on the 31st March 1888.

On the 7th January 1889 a sum of Rs. 10,000 was sanctioned by the corporation for the excavation of a catch-water channel along the hill on the south of the Kennery valley to the west of Dam No. 2, it having been estimated that by this means the gathering ground will be increased by 250 acres and an addition of 10 per cent. obtained to the present lake supply. Work was commenced at once, and fair progress had been made by the close of the year. It is proposed during the ensuing season to line the channel with masonry.

Leakage from the different dams has been gauged and watched during the year, and it is satisfactory to find that there is no cause for anxiety.

Service Reservoirs.—At the Bhandarwada Reservoir, the quarters for the Inspector have been completed. The leakage of the Bhandarwada and Malabar Hill Reservoirs has been the subject of reports separately printed and issued during the year, and the subject was under consideration at the close of the year.

Distribution Mains.—The total length of new mains laid during the year, exclusive of the Arthur Road 27″ main, was nearly eight miles. The 18″ main in Frere Road is the most important one. By the laying of this main, the character of the water-supply in that district has been entirely changed. There are now no complaints, and the shipping is supplied without any difficulty.

The laying of the Arthur Road 27″ main (which, it will be remembered, is to form the last link of the Tansa supply main) was completed on the 31st March 1889. Its total length is 14,338 feet. The first section of the main was put into use on the 23rd January 1889, and materially improved the supply to the Agripada, Dhobiwada, and Warden Road districts. All the connexions with existing service mains are so made that the 27″ main can be used either as a distributing main, or as a leading main to the reservoir, and Tulsi water can now be sent to the city direct if required.

On all the new mains laid down fire hydrants have been fixed at intervals of from 300 to 500 feet, and 200 fire hydrants have also been fixed to old mains. One of the most important undertakings of the year has been the re-surveying of the whole of the water mains and their fittings, and the preparation of revised plans of them.

The total number of new connexions made during the year was 962; after deducting 228 disconnexions, the net increase is 734. The total number of connexions is now 16,098. The increase of 734 is equal to 4·8 per cent. of the whole. The increased demand on account of the new connexions is about $\frac{3}{4}$ millions gallons per day, or about 1,000 gallons for each connexion.

The abolition of dipping wells and the substitution of taps and fountains is being carried out as the distribution arrangements permit.

Waste Prevention.—The measures which have been adopted in accordance with the Liverpool system for the detection of waste were continued throughout the year.

The new works required, but which have yet to be considered, are the following:—Additional filtration, both of the Vehar and Tulsi waters. Additional reservoir accommodation. Road from Vehar to Tulsi. Laying of 9″ and 12″ mains at suitable distances apart throughout the city. Better arrangements for road watering and the substitution of sea water for lake water for this purpose wherever it can be economically effected.

Public Health.—During the year under review, the public health has not been so good as in the preceding year. The total number of deaths from all causes amounted to 22,421, equal to a death-rate of 25·16 per 1,000 of population. The number of deaths last year was 20,513, or a death-rate of 23·25. The average number of deaths for the last five years is 21,480, or a death-rate of 24·97. The usual annual estimated increase of population has been allowed for in the above calculations.

There was an increase of 110 cases of cholera over that of the previous year, being 11 above the average of the last five years. A virulent outbreak occurred at

Gorupdeo, a locality the Health Officer specially referred to in his last annual report as needing drainage, and there were two outbreaks in Borebhat, another locality of imperfect drainage and overcrowding.

Upon an epidemic of small-pox making its appearance in the beginning of the year, a special small-pox hospital was opened, and the measures of sanitation and vaccination that it is usual to adopt on such occasions were fully enforced. The number of deaths was 482 against 108 of the previous year, and 155 the average. The S.S. "Stura" with 627 pilgrims from Java arrived in Bombay with seven cases of small-pox on board. The sick were removed to hospital, and the healthy were landed and placed in a shed on the wharf. After the landing five more cases occurred amongst the pilgrims.

The number of deaths from fever was 6,642 or 970 more than in the previous year, and 332 more than the average. The increase has been chiefly amongst the Hindu low-castes. There have also been increases in the number of deaths from phthisis, diseases of the respiratory system, dysentery, accidents, and other causes. Decreases have taken place in measles, diarrhœa, and diseases of the nervous system.

The proposal to establish a hospital for epidemic diseases at Khetwadi, at first sanctioned by the Corporation, was afterwards cancelled on account of the strong protest from the inhabitants of the neighbourhood. An amended scheme is now under the consideration of a Committee of the Corporation, and meanwhile the sheds at Grant Road and Arthur Road are used on occasions as heretofore.

The city was for some time infested by a large number of paupers from Kathiawar and Guzerat, where the rainfall had been scanty. A famine relief committee was formed by some philanthropic gentlemen, but the immigrants were for the most part sturdy vagrants who refused to work when work was offered to them, as they preferred to beg and breed nuisance and danger in the highways. As the magistrates would not, or could not, convict, the police were powerless to put a stop to the evil. Government disclaimed all responsibility in the matter, and, in default of any better arrangement, the strangers were accommodated in the hospital sheds at Arthur Road. From thence by degrees, and somewhat reluctantly, they returned to their own homes, the cost of conveyance being in most cases provided by charitable persons in Bombay or by the Native States to which they belonged. Some of the immigrants were from British territory, but no offer was made by the authorities to do for them what was done in respect of subjects of Native States by their rulers. It is to be hoped that some measures will be devised to protect Bombay from a recurrence of this infliction.

Owing to the scanty rainfall, the quality of the filtered water from Vehar and Tulsi has not been equal to the average supply, and it is very desirable that the filtering accommodation should be increased. The Health Officer points out that the unhealthiness and nuisances attending the want of proper drainage are enhanced by the rate of increase in population and buildings being greater than the rate of progress in the prosecution of the sewerage works. The most graphic description of the foul state of some districts will not give as good an idea of the truth as a quarter of an hour's visit, and therefore I refrain from saying more on the subject. It is, however, important to bear in mind that even apart from the sanitary aspect of the question, the absolutely necessary addition to the already unwieldy and unmanageable staff of the Health Department, for regularly emptying the rapidly increasing number of cesspools, will entail on the Corporation an immense outlay which might be avoided if the sewerage works were actively proceeded with.

The number of births recorded during the year has been 16,760 against 15,429 for the previous year, and 15,340 the average for the last five years. The birth-rate per 1,000 of population has been 21·67. I regret to say that I cannot place any greater reliance than in previous years on the accuracy of these statistics which show the marvellous and incredible contrast of a birth-rate of 81 per 1,000 among the Eurasian population and 11 per 1,000 among Brahmins.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1888.

(Dr. T. S. Weir.)

The public health has not been so good as in the previous year. Although the mortality in 1888 is higher than in 1887 and the two years preceding, the deaths are, notwithstanding the increase of population, less than in 1883 and 1884. The rate of mortality is over 25·16, as has been calculated. The population I estimate to be about 893,930. The calculation is made in the usual manner by logarithms. Logarithm population 1881—Logarithm population 1872=9, giving the annual increment. Any estimate of the population is very uncertain. It may, however, be taken for granted that the population is increasing more rapidly every year. During the last two years the expansion has been remarkable. Where there were rice-fields two years ago, there are now groups of buildings—houses by ways coalescing into the greater city. The growth and change in the suburbs is marvellous.

The total deaths, the rate of male and female mortality, and the proportion of male to female deaths are shown for a series of years in the following table. But in reading the table, it must be remembered that in 1886 the smallest number of deaths from cholera and small-pox known in Bombay were recorded :—

Years.	Total Deaths.	Death-rate.		Proportion of Male to Female Deaths.
		Males.*	Females.*	
1881	21,856	24·94	33·27	112·97
1882	20,468	23·36	31·14	113·05
1883	23,530	26·62	36·16	119·00
1884	22,542	25·29	34·96	109 01
1885	21,859	24·58	33·80	109·57
1886	20,074	22·45	31·24	108·27
1887	20,513	23·15	31·62	110·32
1888	22,421	25·84	33·74	115.40

* These two columns are calculated on the census of 1881.

The abnormal conditions following on a scanty rainfall have been unfavourable to the public health. These conditions have had to be battled with, but other conditions arising without have had to be contended with. There has been an extraordinary importation of cases of cholera, and an extraordinary immigration of poor from tracts of country where the rainfall was scanty, and therefore where the food supply has been scanty. We have, therefore, had to contend not only against unwholesome conditions within, but with conditions without the city. When the rainfall was scanty in 1876 I pointed out that the mortality would increase, and in this period we may be certain that the abnormal conditions will be followed by increased mortality in proportion to the scantiness of rain and of food. We can only hope by vigilance to save some lives and lessen the fatality.

I anticipated in the annual report for 1883 that there would be an epidemic of small-pox in 1888. An epidemic has occurred with the beginning of the year. The probability of an epidemic is thus referred to in that report:—"The indications of a "resuscitation of small-pox, which have generally been observed in the period preceding "an epidemic, must be carefully looked for towards the end of 1887. I apprehend "the occurrence of an epidemic of small-pox in 1888 from certain indications I "observed late in the hot season of this year; and if cases of small-pox occur in the "monsoon months of 1887, they may be considered, judging from previous experience, "as of grave import."

A special small-pox hospital was opened on the 12th March. Notices pointing out the necessity of vaccination were circulated. The special measures of sanitation and vaccination taken when an epidemic occurs were fully enforced.

Groups of huts occupied chiefly by mill hands and labourers are thus described in the last annual report:—"The most fearful nuisance through want of drainage has been

" caused at Ghorapdev, and were it not for the overflow and escape of sewage to the " sea, Ghorapdev, now thickly populated by mill workers, would cease to be habitable. " To the east of Ghorapdev there are great sewage pools oozing and escaping seawards." Such is the description of conditions amidst which thousands of workers live in Ghorapdev, in the annual report for 1887. And in 1888 there have been two outbreaks of cholera and choleraic diarrhœa in these same huts, amidst these same pollutions—56 cases of cholera, and 37 deaths, so great was the fatality. So virulent an outbreak has not occurred in any other portion of the city. The fatality appeared to be the issue of sewage pollutions. There have also been two outbreaks of cholera in Borebhat, another locality of imperfect drainage. The drainage of Borebhat was very imperfect, but not so defective as the drainage of Ghorapdev. There were open unmade trenches carrying the drainage to cesspools, and from the trenches and cesspools a nuisance such as must arise from sewage trickling over and oozing through shallow trenches, and from sewage settling in and overflowing during rain from cesspools, polluting building floors and soil. Localities such as Ghorapdev have been inhabited before they were prepared for habitation. Pipes are laid to carry water to them; but pipes are not laid nor drains made to carry away this water. I was asked, after my description of the state of Ghorapdev, for a remedy for so much foulness, and I replied, " Drains to carry away the water and liquid refuse." In another portion of the report I have referred to Zawba's cart as evidence of what can be done by simple sanitary improvement for the prevention of cholera.

The quantity of the filtered water from Vehar and Tulsi has not been equal to the average supply. This is due to the smaller rainfall, the lower level of the lakes, and consequently the greater difficulty of removing greater impurity. The impurities have been more than the system of filtration can intercept or remove.

The growth of population has been quicker than the construction of new drains, and the result has been fearful nuisances in localities without drains. Within sight of the Municipal Office was a hideous nuisance near a hotel. A space, the size of the Corporation Hall, was covered with fluid filth from cook-rooms and bath-rooms. The owner of the building was prosecuted, and after some weeks the landlord built cesspools, and the tenant keeps a cart to take away the liquid refuse—what the cesspools hold. And near one of the clubs and near one of the evening resorts there has been a serious nuisance from want of drainage. The tenants are very much to be pitied in these localities, they enter a house, and, having occupied it, find that all the cook-room and bath-room water collects in pools around their dwellings; they then discover that there are no drains.

Old nuisances have been abated, but new nuisances come with new buildings. Here is a description of one which was heard in the Girgam Police Court. Mr. Ryan came to see the nuisance with Mr. Smith; the stench was fearful. It was difficult to believe that people could live in such a stench, but they lived and suffered—all poor people—weavers much afflicted in health. They had dug holes and prepared the rooms for weaving, and, having done so, suffered rather than leave and lose a day in finding a new dwelling. A description of the nuisance may seem unreal to anyone who had not seen it. This is the advantage of a magistrate seeing so great a nuisance, because he will be convinced by sight and smell of foulness and odours that he cannot realise from evidence. It is a trial to stand as we did near that trench and feel the fearful stench. My notes are:—Rooms built on four sides, around open space, square-shaped, and opening on to it. Drainage of all the rooms flows to a trench dug from north to south through open space. From this trench no outlet, trench about 80 feet long, 3 feet wide, and 3 feet deep filled with foul sewage; all water from rooms, except thrown out of back windows, flows to trench. The residents are weavers; complain of nuisance and illness—fever. The rooms are damp; floors on one side wet. Here are the notes on another case near the Ripon Road:—House new; a few months occupied; water collected in pools on south side; waste-water pipes from bath-rooms discharge against walls; tank of sewage on west and south sides; ground on north side wet from sewage; a system of drainage attempted; pipes placed but not connected with street sewer. Here is another case:—New house; 23 waste-water pipes from so many bathing-rooms discharging water on three sides of house; ground around a swamp. But there are more than a hundred such cases even within sight of the Municipal Office. There was a fearful nuisance from the drainage of a hotel. There was a large space covered with water from the cook-rooms and bath-rooms—a pool of filth.

Unless that channels are constructed where towns are growing in Parel, Sewree, and Mahim—the northern district of the island—there will be fearful nuisances. I think it would be better to abandon house connexions for the present, and expend the money

to be spent on house connexions in laying down sewer lines through the northern districts of the island. The need for drains or channels of any kind in one-half the island or, as commonly called, the city of Bombay, is emergent.

The mortality is arranged in the table following by groups of death causes. Contrasted with the preceding year there is an increase of mortality from all chief causes excepting small-pox, measles, diarrhœa, and diseases of the nervous system :—

Return showing the Number of Deaths from different Causes in 1888.

Causes of Death.	Number of Deaths.	Rate per 1,000 of Population.	Remarks.
Small-pox	482	·54	Annual increment of population calculated.
Measles	221	·25	
Fever	6,642	7·45	
Cholera	379	·42	
Phthisis	2,726	3·06	
Diseases of the Nervous System	1,966	2·21	
„ Respiratory „	4,132	4·64	
Diarrhœa	1,006	1·13	
Dysentery	710	·80	
Accidents	385	·43	
All other causes except Still-born	3,772	4·23	
Total	22,421	25·16	

As in previous years, the mortality of male children under one year of age is higher than of females, while from one to three years the incidence of the death-rate does not follow the previous year. From one to two and from two to three years more male children died, and from three to four and from four to five the death-rate of females was higher than of males. From five to six the male mortality was higher than the female. From 6 to 40 years the female death-rate is higher than the male ; between 12 and 40 the female mortality is 7·1 per thousand higher than the male. Over 40 the male mortality increases, and up to 70 is higher than the female. During the last two age-periods females have less chance of life than males. The total female mortality is 7·9 higher than the male ; the excess of female mortality is ·5 less than in 1887.

The mortality of children under one year of age is 31·06 more than in 1887, but over one year and up to five years the mortality is 5·31 less than in the last year. Of the deaths under one year of age, 3,628 were males and 3,028 females, the male death-rate being 325·9 and the female 263·21. The increase in infant mortality may be chiefly ascribed to the resuscitation and the prevalence of small-pox. A further examination of the mortality at early periods of life shows that while the proportion of deaths of infants to population is higher than in the previous year, the proportion of deaths to births is 39·71 or 1·13 more.

The percentage of deaths under one year of age to births is a little higher than the past year. The highest mortality occurred in Byculla, Worli, Chuckla, and Mandvi. These are the sections in which the birth-rate is low. The infant mortality is greatly influenced by the birth-rate and fluctuating condition of population. Still, knowing local condition, the infant mortality indicates the localities where unwholesome influences are active.

The mortality by place of birth indicates the influence of immigrant elements on the public health. The deaths of indigenous are only 91 more than the deaths of immigrants, while in 1887 the deaths of indigenous were 479 more. This indicates a much greater immigrant influence on mortality, and further examining the mortality of 1888 with 1887 according to place of birth the deaths of indigenous in 1888 are 749 more than in 1887, while the deaths of immigrants are 1,137 more.

Amongst two classes of Hindus out of five the mortality is lower, and amongst three higher, than in 1887. The rate of mortality amongst the Hindu population is not so favourable as in the previous year ; calculated on the population of 1881 the mortality is equal to 27·84. There is a considerable increase in the mortality amongst Hindu low-castes. There has been a great increase in the low-caste population, and they live under very insanitary conditions. They are poor, live in poor dwellings in crowded rooms—more than one family in each room—and this Hindus of caste do not do ; they yield not to the food discipline which Hindus obey and obey for their own good.

There is no condition of life which the poor live so unwholesome as the life of the Hindu out-castes.

Many of the buildings in which Jains live are very unwholesome. I have seen some houses so dark on the ground floor during the day that a lamp had to be kept burning. These houses had also bad drains in dangerous positions under the ground-floor. These unwholesome conditions explain to some extent the high mortality amongst Jains. The great immigration of Jains to this city also explains to a greater extent the high death-rate.

There is an increase of mortality in the four great classes of the population usually taken each year for examination. Taking the population of 1881 as the basis of calculations, there is an increase of mortality in the following ratios:—Europeans 1·82, Musulmans ·95, Parsees 2·20, Brahmins 2·77. There has, therefore, been the least increase of mortality amongst Musulmans and Europeans. If the increase in the European and Musulman population could be known, it is probable that there has not been an increase of mortality in these two classes in 1888. In only six years since 1877 has the mortality amongst Europeans been lower. The health of three of the classes—Europeans (19·04), Parsees (22·67), and Brahmins (23·62)—is exhibited in a favourable condition, considering that the ratio of mortality is based on the census taken in 1881. In two of the classes—Europeans and Brahmins—there has been an increase of population from immigration beyond that natural increase which can be estimated. In the report of the previous year I pointed out that imperfect street and house ventilation influenced the mortality of the Musulman population. The house pressure and overcrowding in localities in which great numbers of Musulmans live are very great. The Musulman mortality is really less than shown in the return. Still, the mortality is high. But I hope much from the distribution of population, and the attraction of population to Byculla following the new roads. These new roads will act directly and indirectly towards improving the public health. There is a considerable difference between the male and female mortality in the Musulman population. The male mortality is 28·19, while the female is as high as 39·34 per 1,000 of population.

The mortality has this year gravitated most to the outlying districts; while the incidence of mortality is less or a little more in some of the most crowded districts; it has increased very much in the suburbs where the population has most fluctuated. In Worli, Parel, and Sewri, where the mortality has increased most, the population has nearly doubled. The highest mortality has been registered in Parel (48·49). I have before drawn attention to the foulness of Parel and all the northern portion of the island from want of drainage—a foulness which you know so well. I believe that foulness has an unfavourable influence, and will have a more unfavourable influence as the population becomes denser. In portions of Parel, as in every portion of the northern districts of the island where there is more population than the drainage of which can be received in small cesspools, there are surface collections of sewage polluting the atmosphere. In the past year the highest mortality was registered in 2nd Nagpada, and in this year the mortality is also high (42·95). This is a section of intense house-crowding, imperfect house ventilation and imperfect underground drainage; within the houses from imperfect ventilation, and without from imperfect drainage—air pollution. The drains are sewage tracts under the ground which have to be opened in some lanes more than once a week. In 2nd Nagpada the proportion of deaths of infants is high. The infant mortality indicates generally the districts of most unfavourable conditions and of weak chances of life. The mortality in Upper Colaba (41·15) is due to fluctuating conditions of population. Of the 118 deaths 25 occurred amongst residents under one month. The mortality in Kamathipura (39·92), although higher than in the three previous years, is less than in 1883 and 1884; allowing for the increase of population, it would be still less; the mortality from fevers and dysentery has increased, while the mortality from diseases of the nervous system and of the respiratory system and from diarrhœa has decreased.

Measles.

The mortality from measles is less than in the previous year; 221 deaths were registered, being 326 less than in the last year and 242 less than the average. As in preceding years, the highest mortality has fallen on females; while the female death-rate is ·35 the male death-rate is ·23. In the preceding year the male death-rate was ·55 and the female ·93. The incidence of measles follows the seasonal course observed in the appearance of small-pox. The greatest number of deaths were registered in the month of April. The highest mortality occurred within the first two years of life;

the mortality of males being higher than of females. Under one year of age the mortality amongst male children was 4·22 and amongst females 3·12, and between one and five years of age the male death-rate was 1·79 and the female 2·46.

Small-pox.

Of the large classes of population the highest mortality from small-pox occurred amongst Hindu low-castes, 50 deaths equal to a mortality of 1·01. I do not refer to the small and uncertain population of Negro Africans, although the highest death-rate occurred amongst them, 1 death giving a death-rate of 1·45, while 323 deaths or ·67 per cent. of the total number of deaths occurred amongst the mass of the Hindu population, the mortality being equal to ·79 per 1,000. The mortality amongst Parsees was very favourable, being equal to ·10. The Mussulman mortality was relatively low, being ·34 per 1,000.

Amongst the European population four deaths occurred. In three sections there were not any deaths from small-pox, Colaba Upper, Colaba Lower, and Fort South. The highest mortality occurred in Parel, 2:47. The mortality in Mazagon, Mahalakshmi, Byculla, 1st Nagpada, and Tarwady was high. In the previous year the highest mortality occurred in Colaba and Parel.

Cholera.

The highest mortality from cholera occurred in the following six sections: Mazagon, Colaba Upper, Esplanade, Girgaum, 1st Nagpada, and Fanaswadi. In the previous annual report I referred to the decrease of cholera in Girgaum and in Fanaswadi. In this year there has been a resuscitation of cholera in Girgaum, but in Fanaswadi the prevalence of former years has not occurred. In one portion of Fanaswadi, in which cholera has been frequently epidemic, and in which many cases have always occurred when cholera was prevalent in Bombay, very few cases of cholera have occurred for some years. I refer to Zawba's cart, in former years mentioned in all reports as a place of cholera fatality. The improvements have been the removal of huts, the arrangement of other huts in lines, the construction of open drains and the removal of cesspools. It is instructive that while the population has increased the number of cases of cholera has yearly decreased. The small mortality in 2nd Nagpada (0·31) is remarkable, as this section is in a bad sanitary condition; but although the mortality from cholera is low the mortality from other causes as measles and fevers is high. In both Nagpadas insanitary conditions of dwellings and of drainage of the worst kind exist. The houses are overcrowded, badly ventilated, and badly drained. The drains in the streets are mere water channels built over, and which have to be opened frequently. As the lanes have to be broken frequently to clean the drains they are in bad order. Eight of the deaths in Colaba occurred in the lunatic asylum, the ninth was of a servant in the lunatic asylum. Although the total mortality is higher than the previous year it has decreased in the following sections:—Market, Chuckla, Dhobi, Talao, and Mahalakshmi.

Five hundred and thirty-eight cases of cholera came to my notice, and 379 ended fatally. Of the 538 cases 73 were born in Bombay and 454 were born somewhere out of Bombay; in the previous year 75 were born in Bombay and 346 somewhere else. The percentage of deaths to attacks was 70·44. Of the total cases 84·3 per cent. were strangers. The great labouring mass rolling towards this city is increasing. It seems as if the labouring population who toil and the poor who do not toil were increasing enormously. The industrial prosperity of the city is attracting enormous numbers of the poor and indigent who can only profit indirectly by the general prosperity. If the length of residence is grouped into two periods under three months the following results are found:—

——	Cases.	Deaths.
Under 3 months - - -	135	85
Under 6 months - - -	88	61

A large number of cases amongst well-water drinkers has occurred. In former years the returns indicated that the use of well-water was becoming less common; the returns now indicate that it is increasing. In the past year, owing to increase of population and less pipe-water relatively to population, the use of well-water was

more general than before. A classification of cases of cholera according to water-supply gives the following results:—

—	Attacked.	Died.	Percentage of Deaths to Attacks.
Vehar and Tulsi water consumers -	397	297	74·8
Well-water drinkers - - -	62	33	53·2
Unknown - - - - -	79	49	62·02

An examination of the dwellings of those who suffered from cholera gives very interesting information. As many as 396 of the cases, *i.e.*, 73·60 per cent., lived on ground-floors. In the previous year 61·59 per cent. lived on ground-floors. The number on ground-floors who suffered from cholera was more than in 1887, but the number on the first and second floors was less, although the total number of cases of cholera was 538 in 1888, whereas in 1887 the total number was 427. While 73·60 per cent. of the cases occurred on ground-floors and 14·49 per cent. on the first and second floors, it has to be remembered that the percentage of ground-floors to all houses is 40·01, and of first floors 26·34.

The figures show a connexion between residence and material conditions and the incidence of cholera, and indicate that persons living on ground-floors, and who are poor, are most susceptible to cholera. It has to be remembered that persons living on ground-floors are generally of the poorer classes, and the conditions of dwelling amidst which the poor live and the conditions that control their lives are not so favourable to vitality as the conditions under which the classes of more opulence who reside on the higher floors live. The condition of dwelling mostly observed during the last year where cases of cholera occurred is dampness—dampness from imperfect drainage and imperfect ventilation, the condition of life found influencing most of the cases—bad dwelling and bad living—and this has always been so in Bombay.

The average number of persons to a room is 3·5, and to a house 59·5. The house-crowding is fearful, and the contamination from it terrible. Overcrowding is a condition most difficult to influence in this city. In the last annual report I wrote that it appeared to me that it is not practically possible to prevent overcrowding, but although it may not be possible to prevent overcrowding the effects of overcrowding may be made less hurtful by more openings for the escape of foul air and the entrance of pure air.

The mortality from fevers is 479 more than the average, and the death-rate is 7·45 against 6·36 in 1887. In 1886 there was a remarkable reduction in the mortality from fevers; 5,820 deaths were registered, being 822 less than in the year before, and in 1887 there was a further reduction in the mortality from fevers, 208 deaths less than in 1886 being registered. The increase of mortality is chiefly amongst Hindu low-castes and Hindu out-castes; amongst Brahmins the number of deaths is the same, but the rate of mortality is less; amongst Europeans, Jews, Bhatias, and Lingaets the mortality is less than in the previous year. Of the total deaths from fevers 5,001 were referred to remittent fever, being 283 more than the average; 250 were ascribed to ague, being 16 more than the average; 1,381 were referred to simple continued fever, being 188 more than the average; 10 were ascribed to enteric fever, being seven less than the average.

It is noteworthy that the increased mortality from fevers is chiefly in the suburbs and in the districts in which the population has rapidly advanced, and in which the advance of population has been greater than the advance of works and of channels to carry away the refuse and liquids brought to these districts in pipes. In some of the most densely populated portions of the city the mortality is less than in the previous year. In the Fort North and South, Esplanade, Chuckla, and Bhuleshwar the mortality is less than in the previous year [illegible] in the districts in which the population has most rapidly advanced and the

which the highest fever death-rate was registered in the previous year. Sewri occupies the second place (14·58) in the fever death-rate. In Parel and Sewri there are no drains, the liquid refuse is absorbed in the soil, and there is great sewage pollution; in Parel the drainage which is not absorbed near dwellings flows to trenches by the side of the railway embankments; these trenches are a cesspool from the north to the south—a foul boundary. And beyond sewage pollution there is a rapidly expanding population. In Sewri five new mills are being constructed. In the suburbs where the mortality from fevers ought to be low it is high, and it is to be apprehended that with increasing population the mortality will increase. The great sanitary defect in the suburbs is the absence of drainage. Here is the result that the mortality from fevers in some of the most densely populated portions of the city—some having good drains and some having bad drains—is less than in sparsely populated districts having no drains. In 1886 the highest mortality from fevers occurred in Chuckla, a very densely populated district. In the following year Chuckla occupied the second place, having a mortality of 11·28, and in the past year the mortality in Chuckla has further decreased a little, being 10·74 against 11·28. Where Sewri and Tarwadi join there are trenches or ditches, some dug by the Health Department; these trenches and ditches overflow on to the foreshore, and were it not for them there would be most fearful nuisances. There are pools of sewage, and from these pools trenches to the foreshore have been dug. When the sewage in the pools increases the trenches carry away the overflow. In the northern portion of the island there are fearful nuisances from want of drainage; near the sea the nuisance is less because of natural drainage, but where there is not natural drainage the sewage oozes to lower level and pollutes the ground. A fearful nuisance has been caused at Ghorupdev, and were it not for the overflow and escape of sewage to the sea Ghorupdev would be in a fearful state. To the east of Ghorupdev there are great sewage pools oozing seawards.

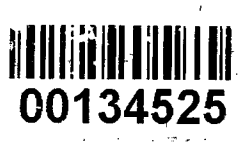
The high mortality in Kamathipura (13·63) is influenced by the large proportion of out-castes in that section. 22·23 per cent. of the out-caste population lived in Kamathipura in 1881, and the mortality from fevers among Hindu out-castes is much higher than in any other class.

The mortality from phthisis is 25 more than in the last year, but 177 less than the average of the five previous years. The six sections in which the highest mortality occurred in 1887 are also the six sections in which the highest mortality has occurred in 1888. This is remarkable, and the sanitary value of this record as an indication of unwholesome conditions cannot be misunderstood. The six sections are—2nd Nagpada, Chuckla, Bhuleshwar, Umerkhari, Khara [illegible], and Girgaum. Excluding the last section, which is Girgaum, the other sections are densely populated.

The section of Kamathipura which had descended to the 8th place in 1887 in the phthisical record has again ascended to the 7th place in 1888. In the previous five years there had been a progressive fall in the phthisical mortality in Kamathipura. I would urge that the system of drainage and house connexions be completed and extended over Kamathipura. One of the most populous and one of the most unwholesome streets to which the system of drainage has not yet been extended is Duncan Road. It is necessary that the drainage of Kamathipura should be completed, and I hope to see the section of Kamathipura as a registration unit of drainage complete. Until the drainage of the section has been completed it is not possible to estimate the effect of the system of drainage on the health of the people. There is the disturbing factor of an increasing population, and secondly an incomplete system of drainage; the old system has not been completely removed nor has the new system been completed. It is unsatisfactory because great improvements have been made, but it is not possible to appraise these improvements.

Births.

The number of births is, with one exception, the largest yet registered in any one year. 16,760 births against 15,429 in the year before were registered, equal to a birth-rate of 21·67. This improvement is satisfactory. Of the living births, 8,669 were males and 8,091 fe[illegible]. The birth-rate fluctuates very much according [illegible] The birth-rate amongst Eurasians is over 81 per [illegible] it is as high as 46·39



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